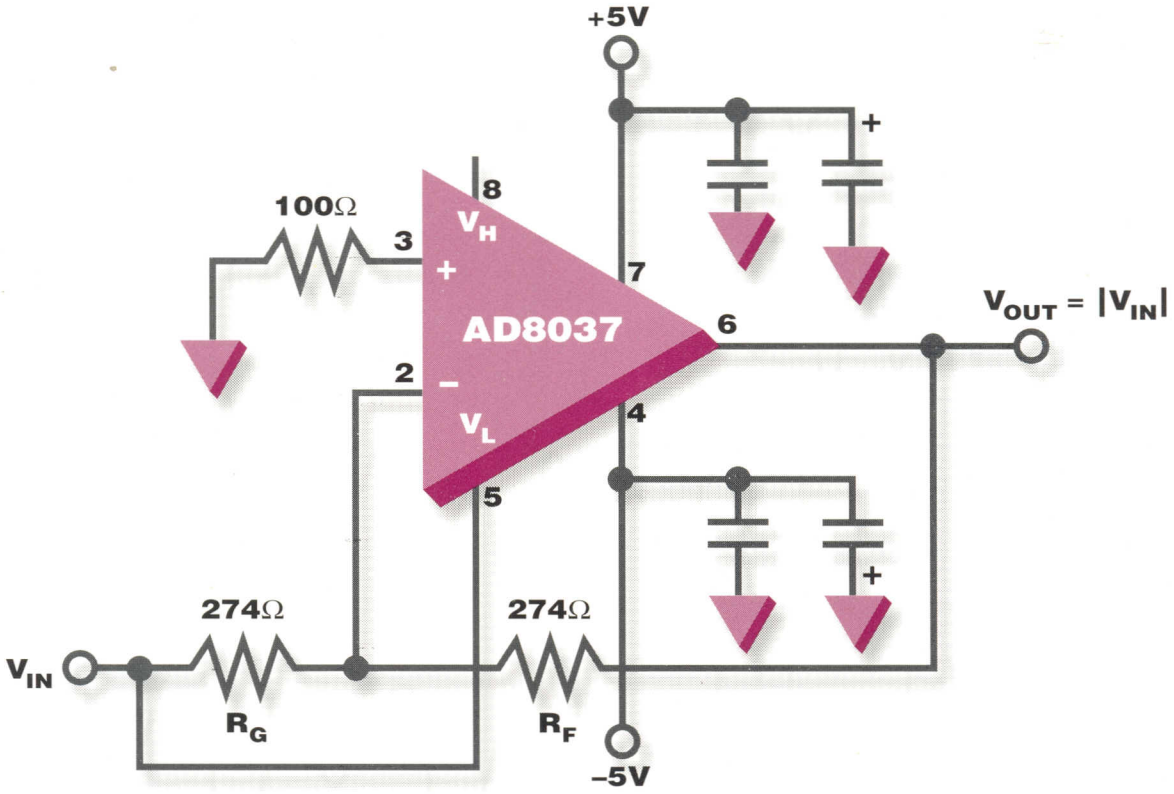
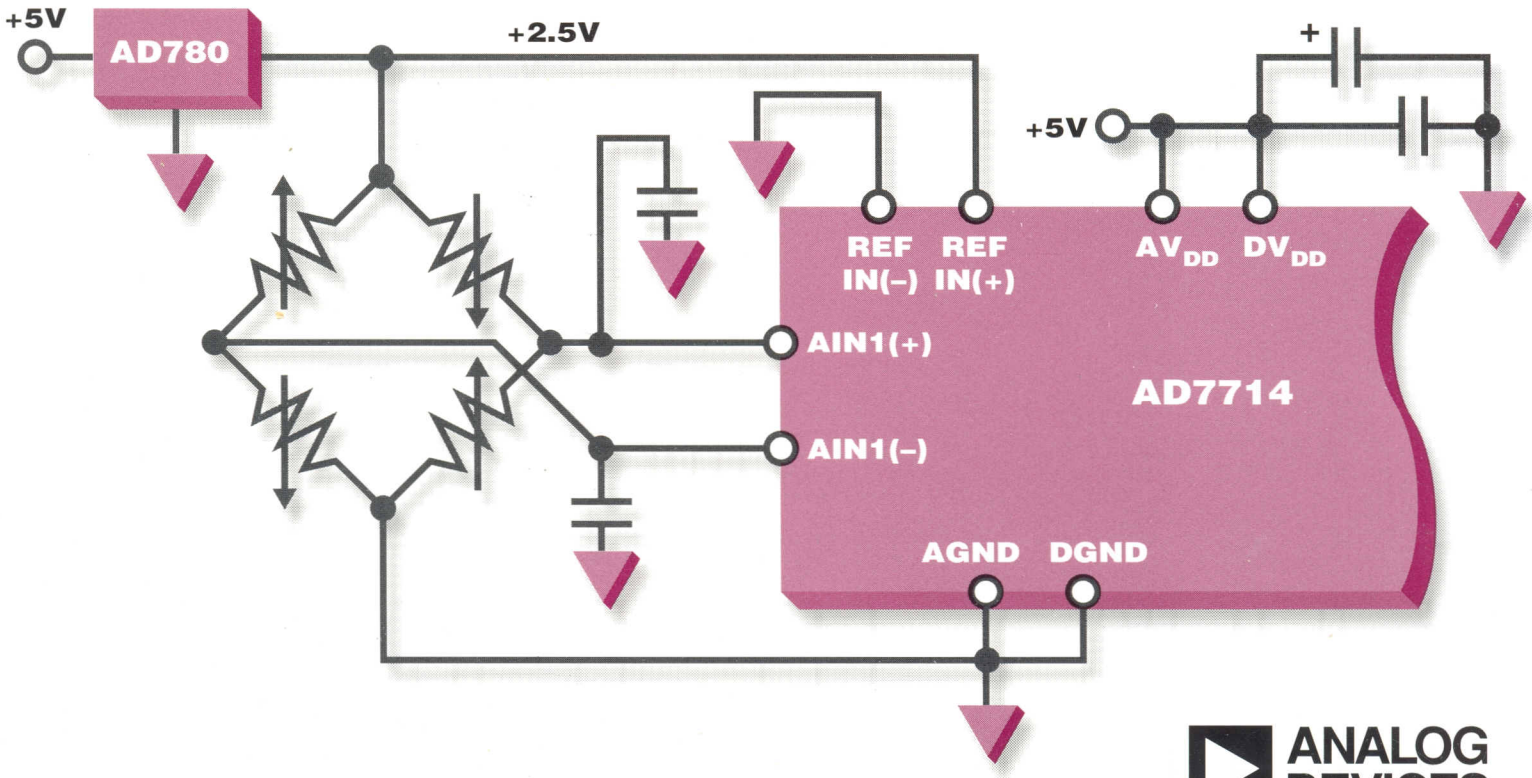
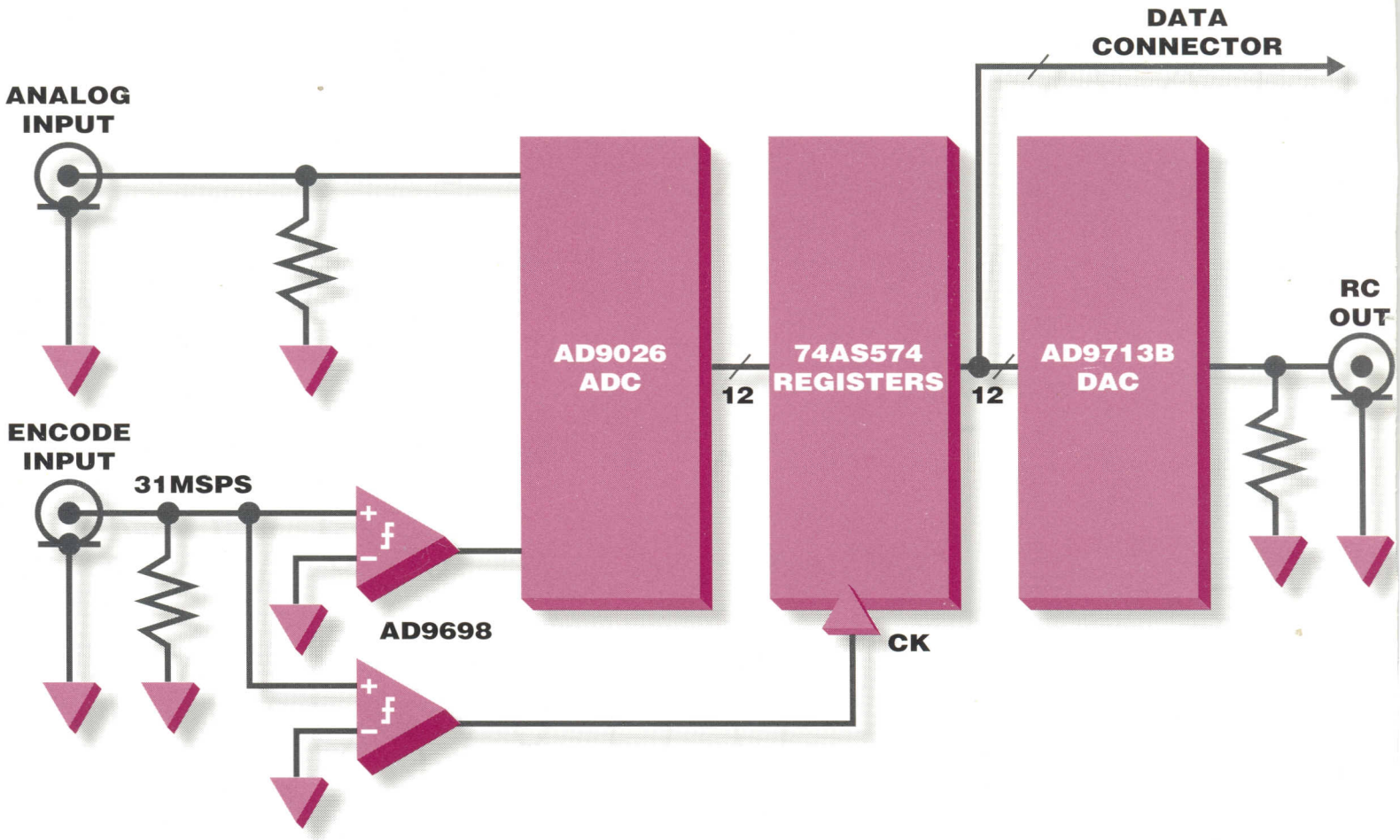
NEW PRODUCT APPLICATIONS – 1995

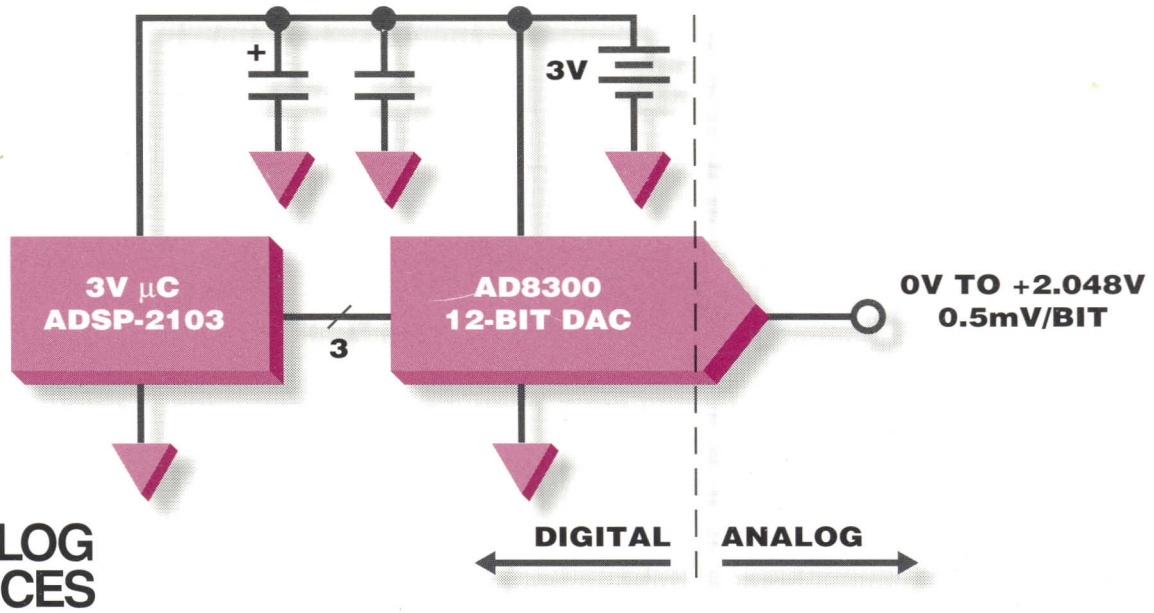


FULL-WAVE RECTIFIER



ANALOG DEVICES





ANALOG DEVICES

WORLDWIDE HEADQUARTERS
One Technology Way, P.O. Box 9106
Norwood, MA 02062-9106, U.S.A.
Tel: (617) 329-4700, Fax: (617) 326-8703

Printed in U.S.A.
April, 1995

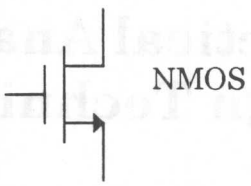
Practical Analog Design Techniques

First Printing Errata Sheet

Practical Analog Design Techniques
First Printing Errata Sheet - April, 1995

Figure 1.6: The label *Q2* should be removed from the NPN transistor on the right-hand side of the diagram.

Figure 1.7: The NMOSFET transistor should be shown as follows for consistency:



Page 1-22: Next to last sentence on the page should read: *To reduce the effects of unwanted noise pickup, a capacitor is recommended across A2's feedback resistance to limit the circuit bandwidth.....*

Figure 1.13: There should be a notation that the bandwidth measurements are *without* the input filter and the 10Hz noise filter.

Page 1-26: The first sentence of the second paragraph should read: *Of course, the amplified bridge output appears only during the measurement ....*

Page 2-16: Second sentence last paragraph, *50* should be *50Ω.*

Page 2-20: Second sentence in first paragraph should read: *This driver type is usually non-inverting....*

Page 2-20: Second sentence in second paragraph should read: *For high performance in such demanding applications....*

Page 2-23: Last sentence in first paragraph should read: *The extended frequency response and lower power helps achieve low distortion at higher frequencies, while operating at much lower quiescent power on supply voltages up to 12V.*

Figure 2-22: The dotted capacitor in parallel with C_{OUT} should be labeled C5.

Figure 2-30: The feedback resistor in parallel with C1 should be labeled R1.

Figure 3.6: Replace with following diagram for more clarity:

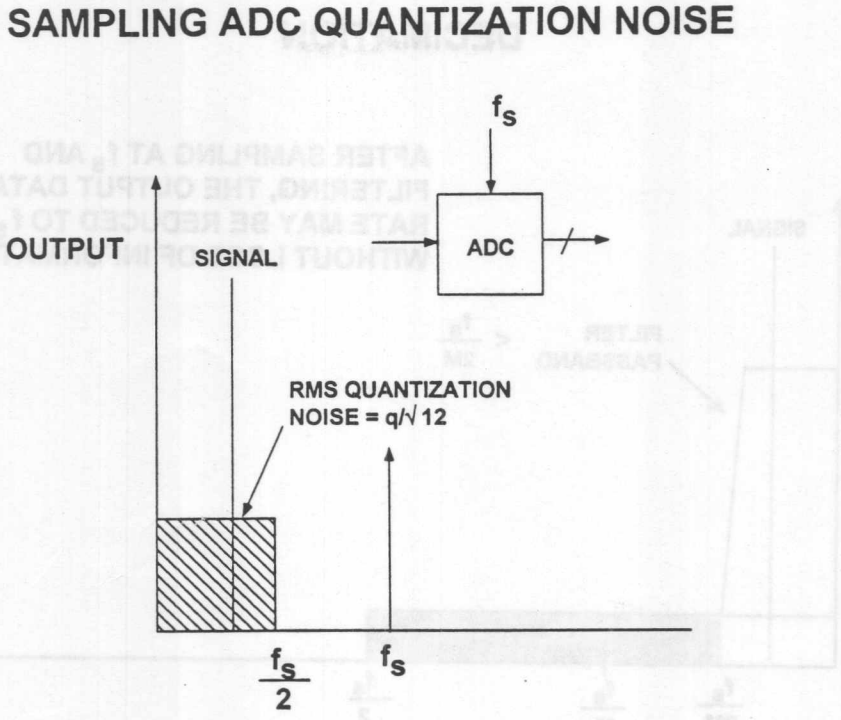


Figure 3.7: Replace with following diagram for more clarity:

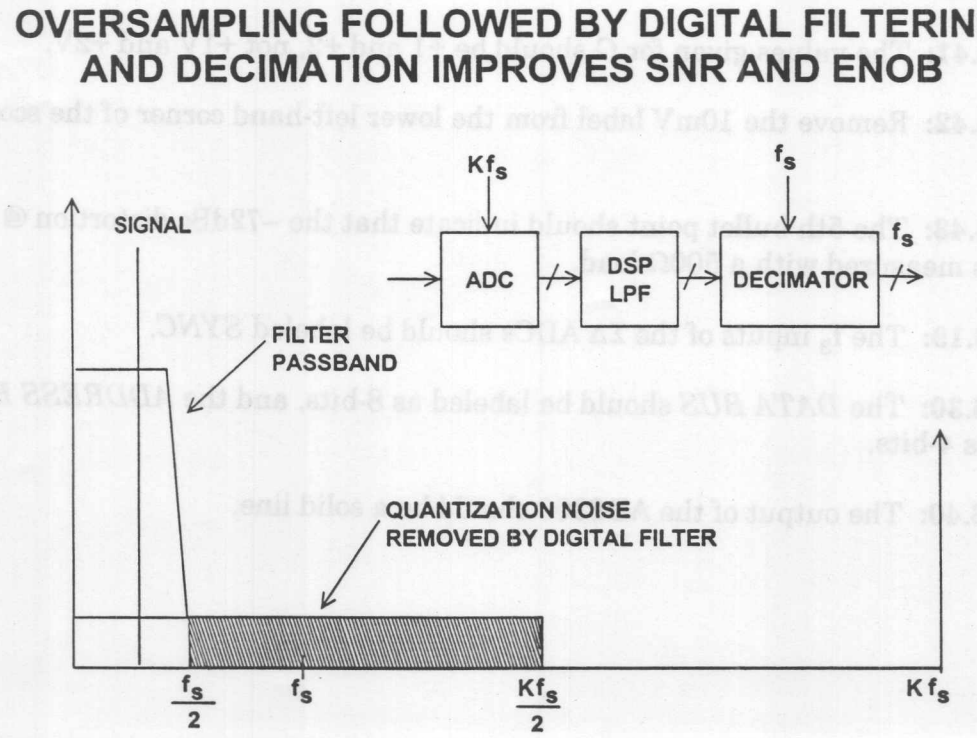


Figure 3.8: Replace with following diagram for more clarity:

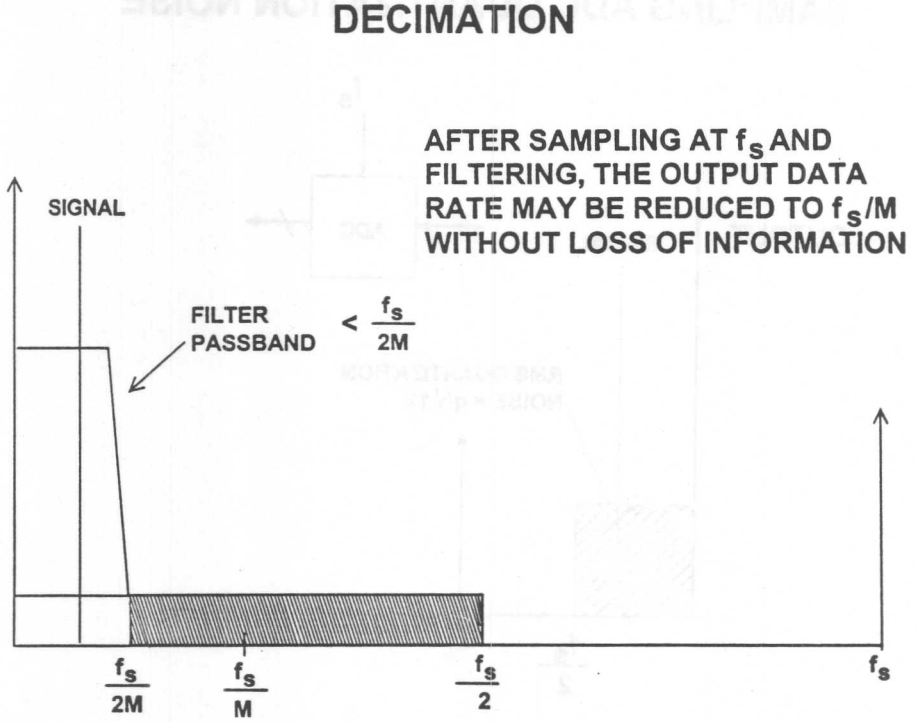


Figure 4.38: The figure labeled *B* should also have the two input protection diodes as in the figure labeled *A*.

Figure 4.41: The values given for G should be +1 and +2, not +1V and +2V.

Figure 4.42: Remove the 10mV label from the lower left-hand corner of the scope photo.

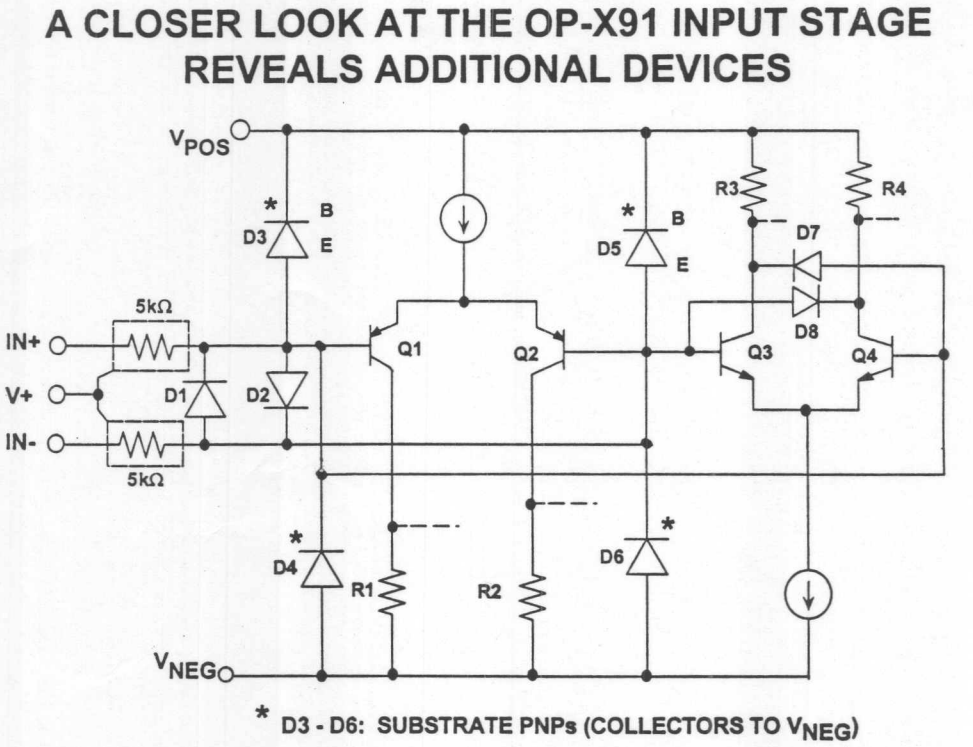
Figure 4.43: The 5th bullet point should indicate that the –72dBc distortion @ 20MHz is measured with a 500Ω load.

Figure 6.19: The f_S inputs of the ΣΔ ADCs should be labeled *SYNC*.

Figure 6.30: The *DATA BUS* should be labeled as 8-bits, and the *ADDRESS BUS* labeled as 4-bits.

Figure 6.40: The output of the AD8300 should be a solid line.

Figure 7.5: Replace with the following corrected schematic:



Page 9-22: In the second sentence of the last paragraph, *5s* should read *5μs*.

Page 9-35: In the first sentence of the last paragraph, *1F* should read *1μF*.

Figure 9.38: In the last bullet point, *powered* should read *powdered*.

Page 9-45: In the third sentence of the last paragraph, the *829* should be changed to *824*.

Figure 9.40: The top input of U1 should be labeled +, and the bottom input – .

NEW PRODUCT INDEX

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* **Preliminary Technical Information**

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* ***Preliminary Technical Information***

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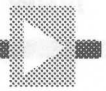
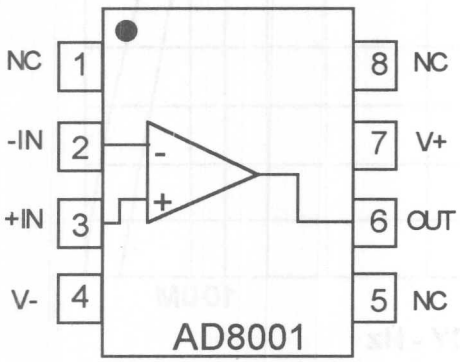


SECTION 1
AMPLIFIERS

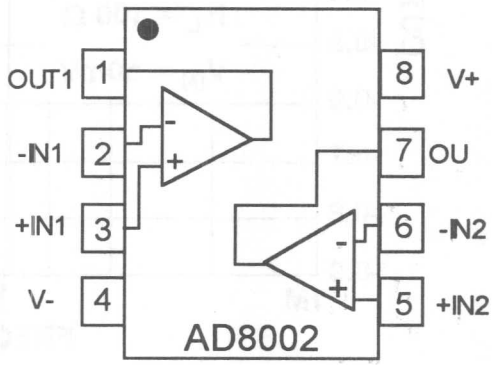
Video Amplifiers
Precision Amplifiers
High Speed Comparators
Isolation Amplifiers

AD8001/AD8002*
800 MHz, 50 mW, Current Feedback Amplifiers

The AD8001 and AD8002 use a proprietary process to achieve small signal bandwidth of 800 MHz at only 50 mW of power!



NC = NO CONNECT

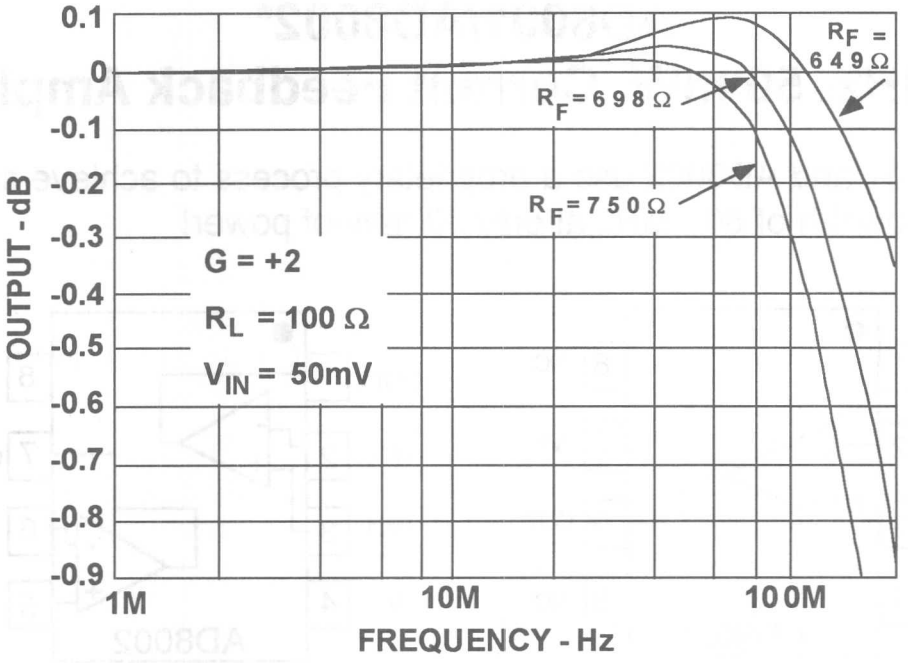


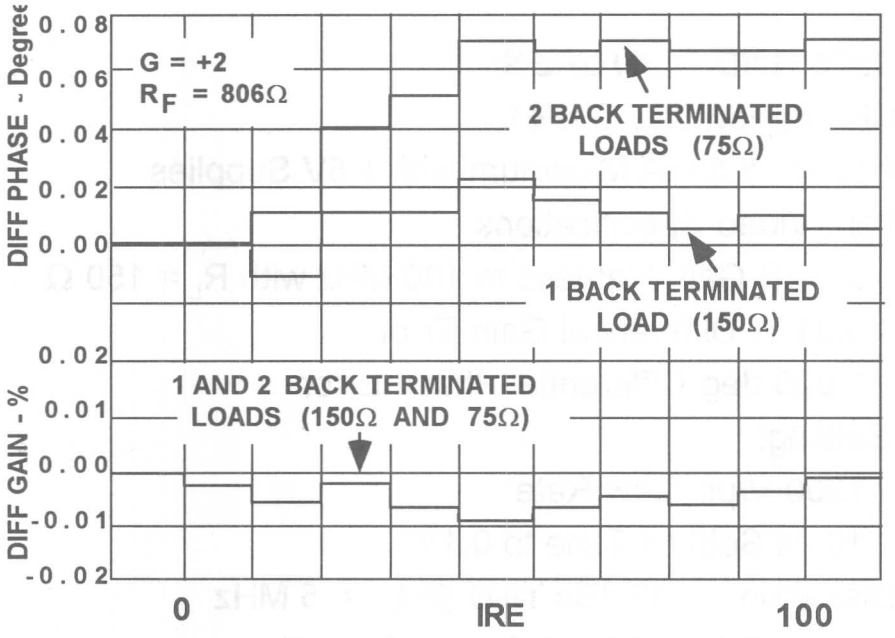
NC = NO CONNECT

KEY SPECS AND FEATURES:

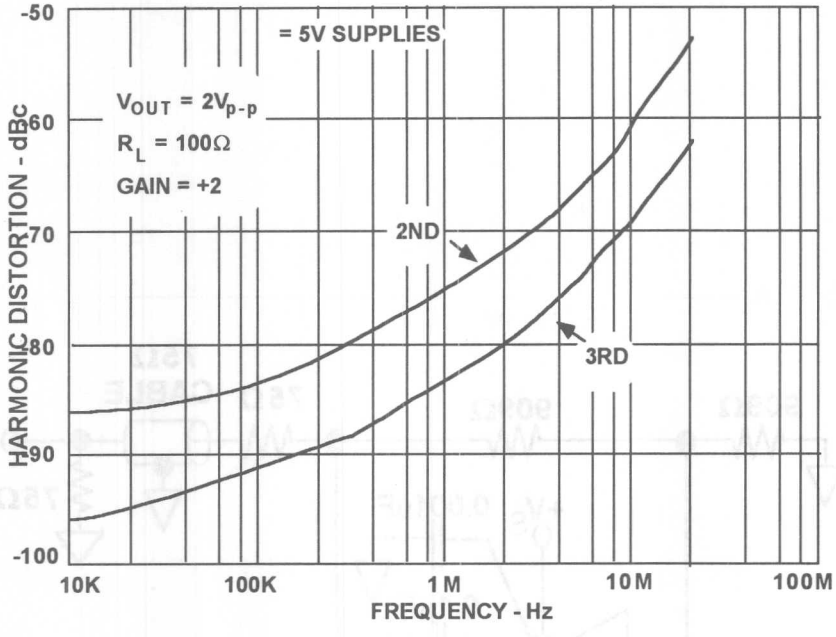
- 800 MHz Bandwidth, G = +1
- Low Power: 5.5 mA Maximum with ± 5V Supplies
- Excellent Video Specifications
  - » 0.1 dB Gain Flatness to 100 MHz with R_L = 150 Ω
  - » 0.01 % Differential Gain Error
  - » 0.025 deg Differential Phase Error
- Fast Settling:
  - » 1200 V/µs Slew Rate
  - » 10 ns Settling Time to 0.1%
- Low Distortion: - -65 dBc THD @ f_c = 5 MHz
- High Output Drive: 70 mA Output Current
- 8 Pin Plastic DIP and SOIC Packages
- -40 deg C to + 85 deg C Operating Range

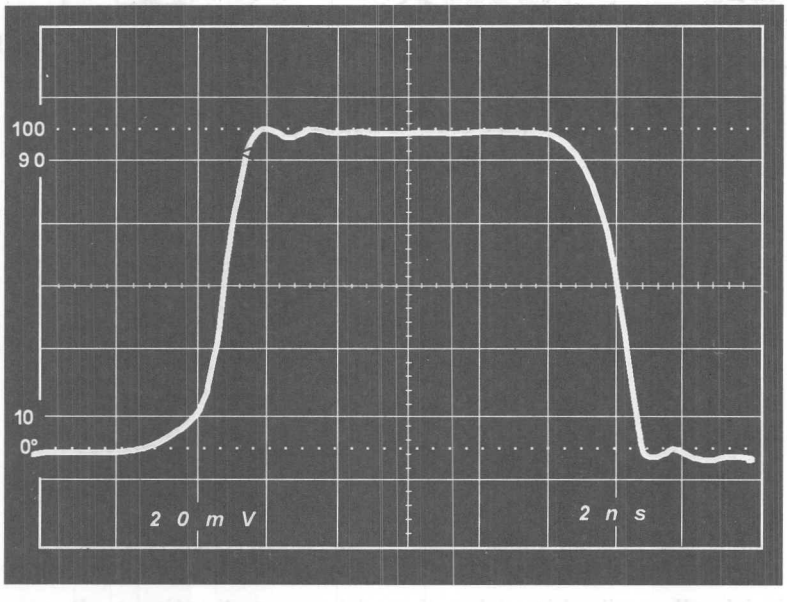
**Preliminary Technical Information*



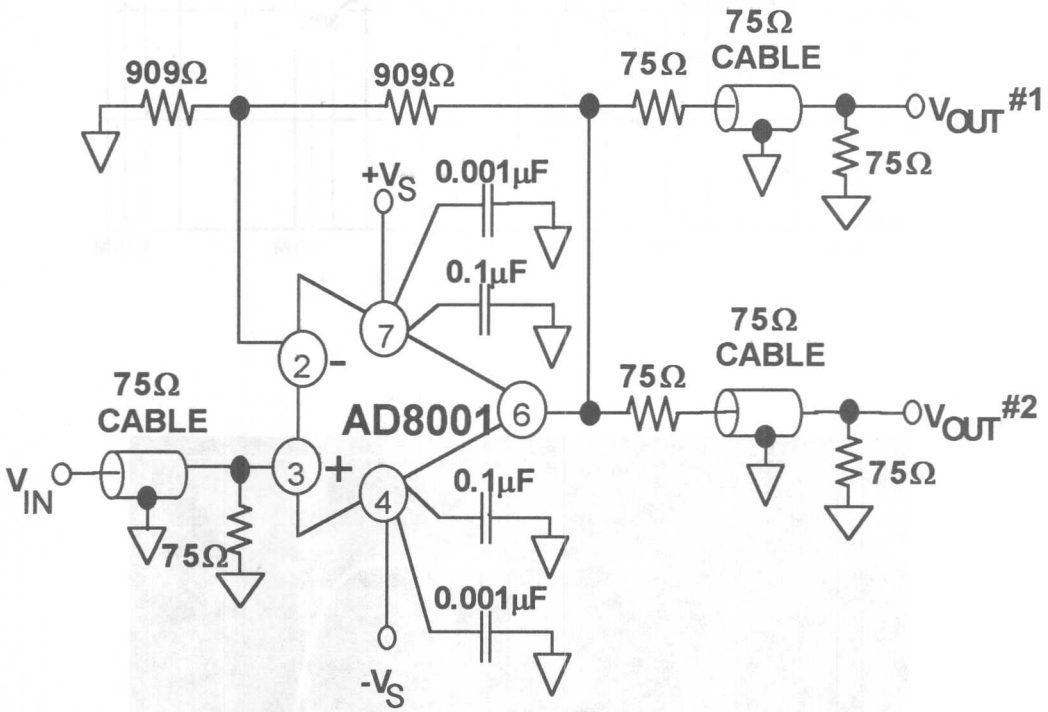


The AD8001 and AD8002's excellent gain flatness and low differential gain and phase error make them ideally suite`d for video applications such as cameras and video switchers.





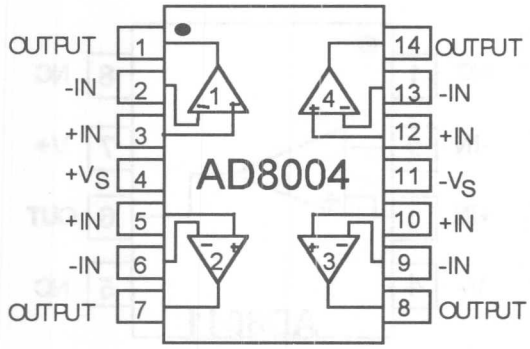
The AD8001 and AD8002's low distortion and fast settling time make them an excellent choice for buffering high speed A-D Converters.



The AD8001 is ideally suited in video line driver applications. It provides > 40 dB of isolation at 5 MHz when driving two 75 ohm back-terminated loads.

AD8004*
3000V/µs, Quad, Current Feedback Amplifier

The AD8004 offers the highest slew rate of any high speed quad amplifier available today!



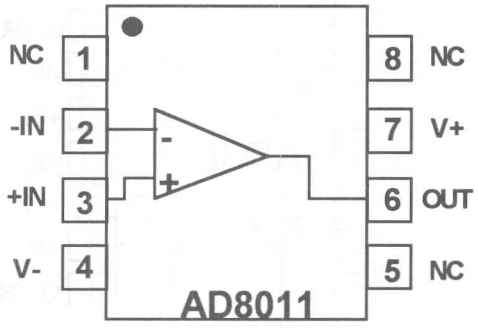
KEY SPECS AND FEATURES:

- Very Fast Settling
  - 3000V/µs Slew Rate
  - 10 ns Settling Time to 0.1 %
- 400 MHz Small Signal Bandwidth, G = +1
- Low Power: 140 mW Total (3.5 mA/Amp), V_s = ± 5V
- Excellent Video Specifications (G= +2)
  - 0.1 dB Gain Flatness to 30 MHz with R_L = 150 Ω
  - 0.05% Differential Gain and Phase Error
- Low Distortion: -65 dBc THD @ f_c =10 MHz
- 50 mA Output Current Drive
- Single or Dual 5V Supply Operation
- 14 Pin Plastic DIP and SOIC Packages
- - 40 deg C to + 85 deg C Operating Range

**Preliminary Technical Information*

AD8011
200 MHz, 5 mW Current Feedback Amplifier

The AD8011's combination of high speed and low quiescent current make it an ideal choice for power-sensitive high speed CCD imaging systems such as portable scanners, copiers and cameras.



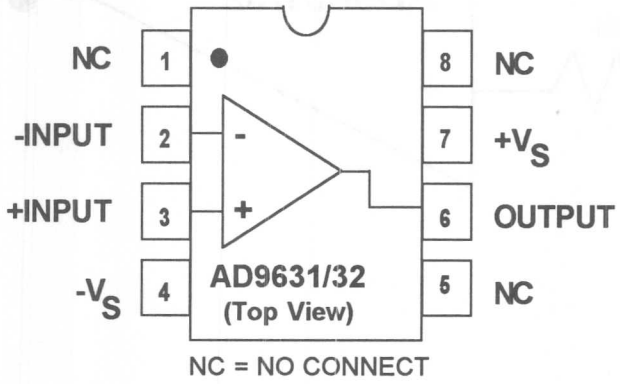
NC = NO CONNECT

KEY SPECS AND FEATURES:

- 400 MHz Small Signal Bandwidth, G = +1
- Low Power: Only 5 mW with V_s = + 5V
- Excellent Video Specifications
  - 0.1 dB Gain Flatness to 25 MHz with R_L = 150 Ω
  - 0.02 % Differential Gain Error
  - 0.06 deg Differential Phase Error
- Fast Settling
  - 3460 V/µs Slew Rate, G = +2, V_s = ± 5V
  - 14 ns Settling Time to 0.1 %
- 50 mA Output Current Drive
- Single or Dual 5V Supply Operation
- 8 Pin Plastic Mini-DIP or SOIC
- - 40 deg C to + 85 deg C Operating Range

AD9631/AD9632
320 MHz, Ultra-Low Distortion, Voltage Feedback Amplifiers

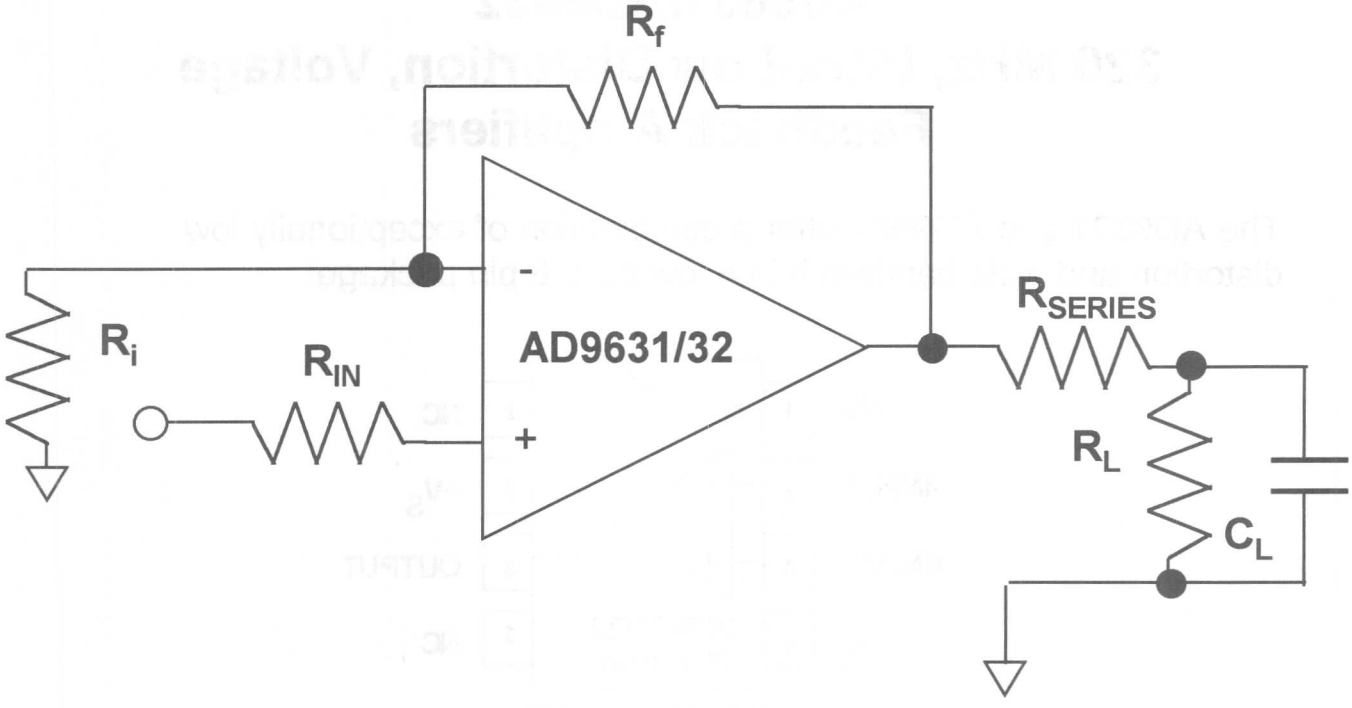
The AD9631 and AD9632 offer a combination of exceptionally low distortion and wide bandwidth in a low cost, 8 pin package!

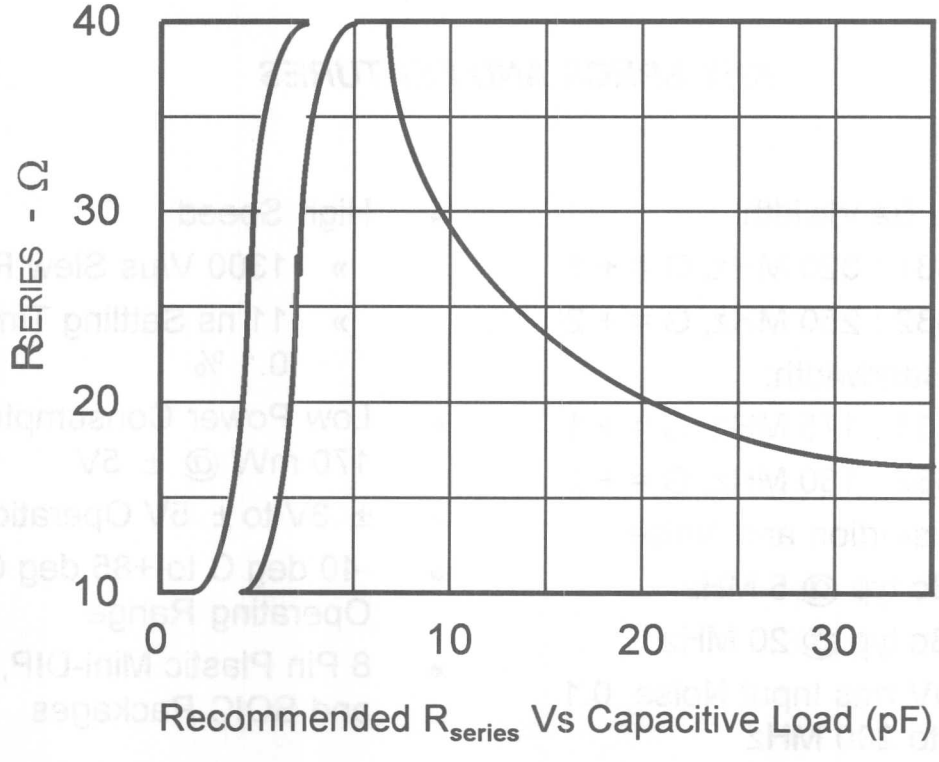


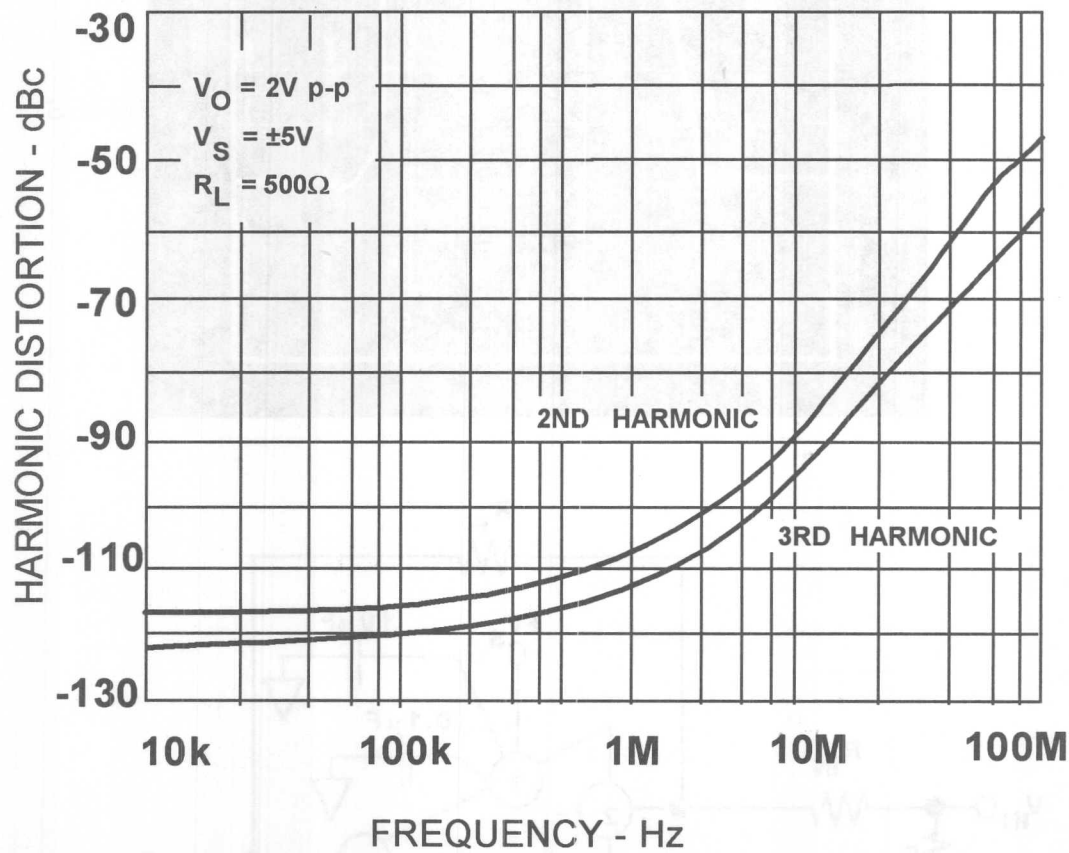
NC = NO CONNECT

KEY SPECS AND FEATURES

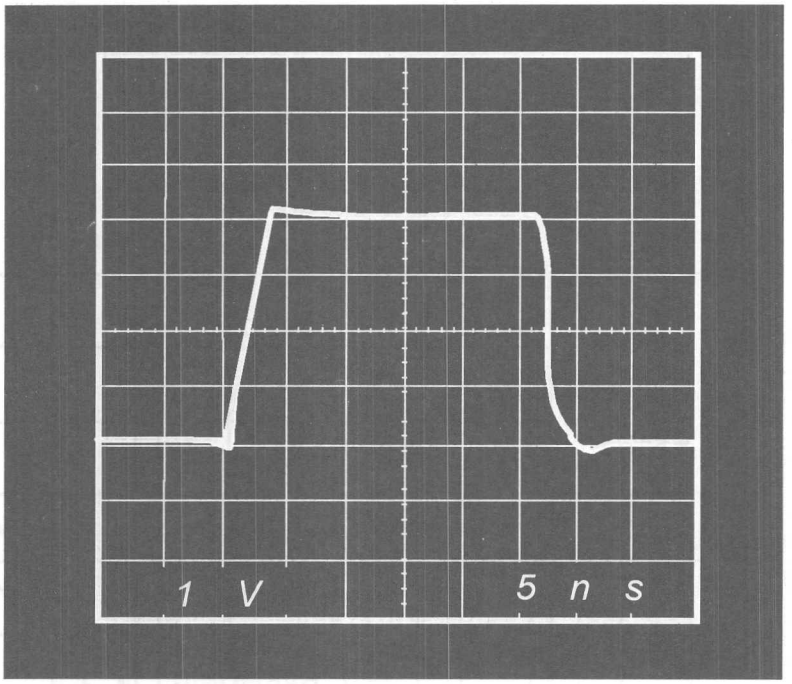
- Small Signal Bandwidth:
  - AD9631 : 320 MHz, G = + 1
  - AD9632 : 250 MHz, G = + 2
- Full Power Bandwidth:
  - AD9631 : 175 MHz, G = + 1
  - AD9632 : 180 MHz, G = + 2
- Ultra-Low Distortion and Noise
  - 95 dBc typ @ 5 MHz
  - 72 dBc typ @ 20 MHz
  - 100 µV rms Input Noise, 0.1 MHz to 200 MHz
- High Speed
  - 1300 V/µs Slew Rate
  - 11 ns Settling Time to 0.1 %
- Low Power Consumption: 170 mW @ ± 5V
- ± 3V to ± 5V Operation
- -40 deg C to +85 deg C Operating Range
- 8 Pin Plastic Mini-DIP, Cerdip and SOIC Packages

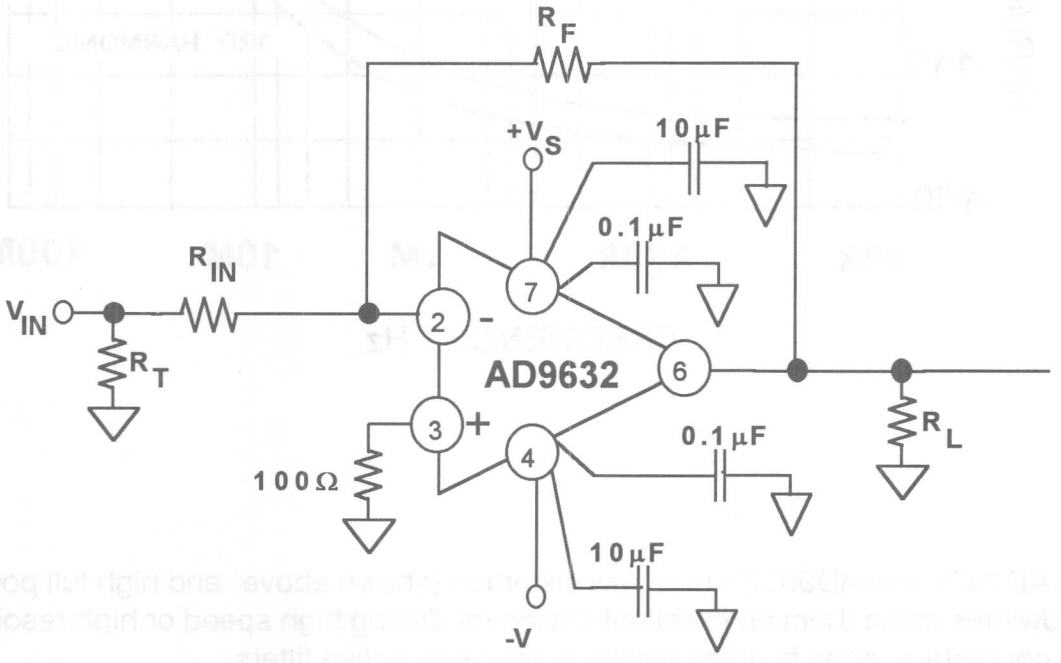

R_f
R_i
R_{IN}
AD9631/32
-
+
R_{SERIES}
R_L
C_L


40
30
20
10
0
10
20
30
R_{SERIES} - Ω
Recommended R_{series} Vs Capacitive Load (pF)



The AD9631 and AD9632's ultra-low distortion (shown above) and high full power bandwidths make them an excellent choice for driving high speed or high resolution A-D converters, or as building blocks in precision active filters.

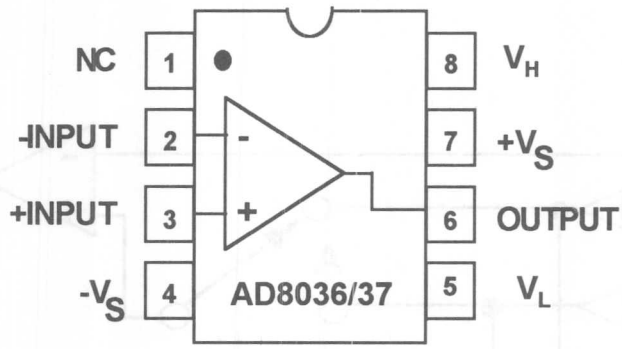




The AD9631 and AD9632's exceptional transient response (very high slewing rate and fast settling times) make these amplifiers ideally suited as pulse amplifiers, or as an I-V converter for a high speed current output DAC.

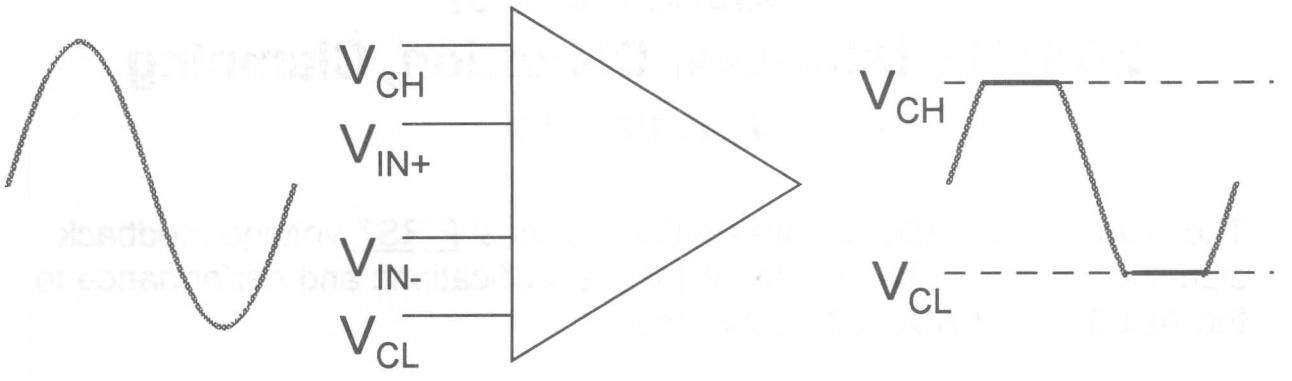
AD8036/AD8037
270MHz, Ultra-Low Distortion, Clamping Amplifiers

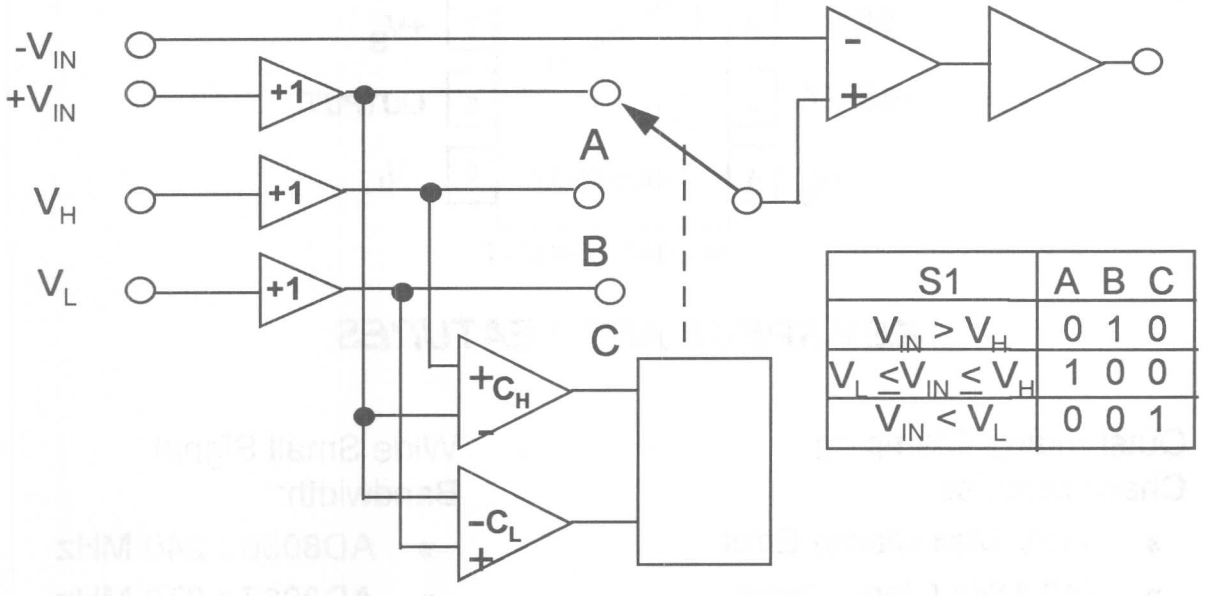
The AD8036 and AD8037 are Analog Devices' FIRST voltage feedback clamp amplifiers. They are identical in specifications and performance to the AD9631 and AD9632, respectively.



KEY SPECS AND FEATURES:

- Outstanding Clamping Characteristics
  - » 5 mV Max Clamp Error
  - » 240 MHz Clamp Input Bandwidth
  - » ± 3.9 V Clamp Input Range
- Ultralow Distortion : -72 dBc typ @ 20 MHz
- Low Noise : 4.5 nV/ $\sqrt{Hz}$
- ± 3V to ± 5V Operation
- Wide Small Signal Bandwidth:
  - » AD8036 : 240 MHz
  - » AD8037 : 270 MHz
- High Speed Performance:
  - » 1500V/us Slew Rate
  - » 16 ns Settling Time to 0.01%
- -40 deg C to +85 deg C Operation
- 8-Pin DIP, CerDIP and SOIC Packages

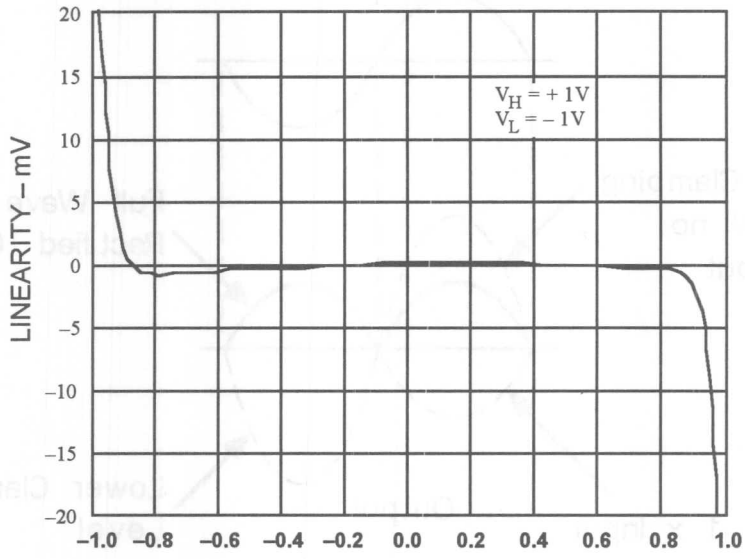




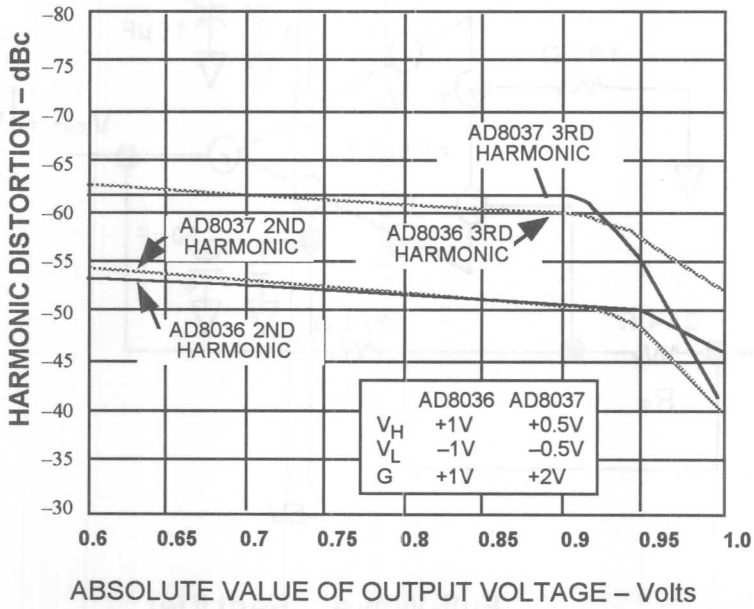
S1	A	B	C
$V_{IN} > V_H$	0	1	0
$V_L \leq V_{IN} \leq V_H$	1	0	0
$V_{IN} < V_L$	0	0	1

A *CLAMP AMPLIFIER* limits its output to user-defined programmed levels...conventional clamp amplifiers using output stage clamping techniques exhibiting poor clamp accuracy (typ > 100 mV) and increased distortion and nonlinearity in the clamp region.

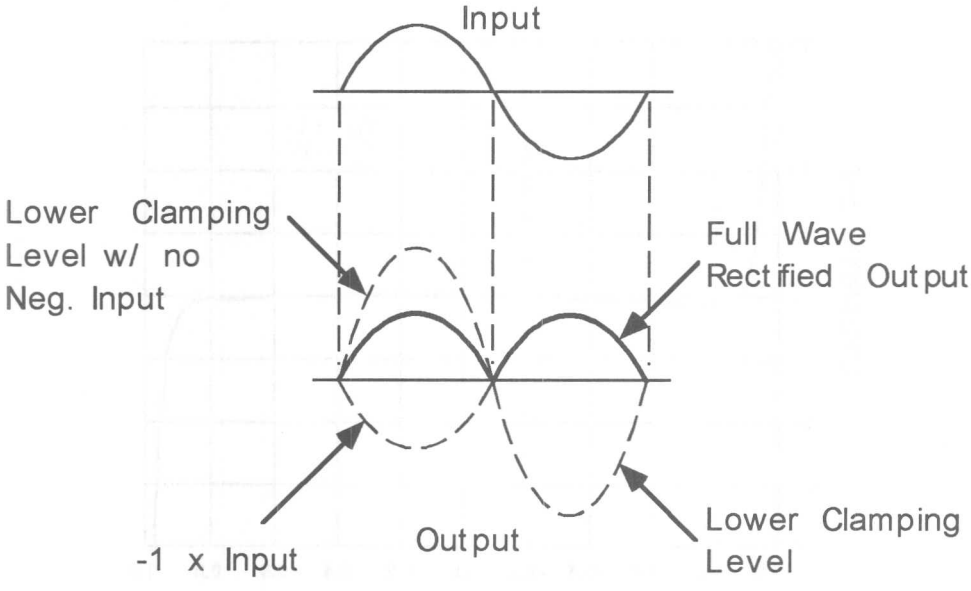
The AD8036 and AD8037 use a proprietary, patent pending CLAMPIN™ input stage clamping architecture, to achieve a >10x improvement in both clamp accuracy and nonlinearity over conventional output stage clamp designs.

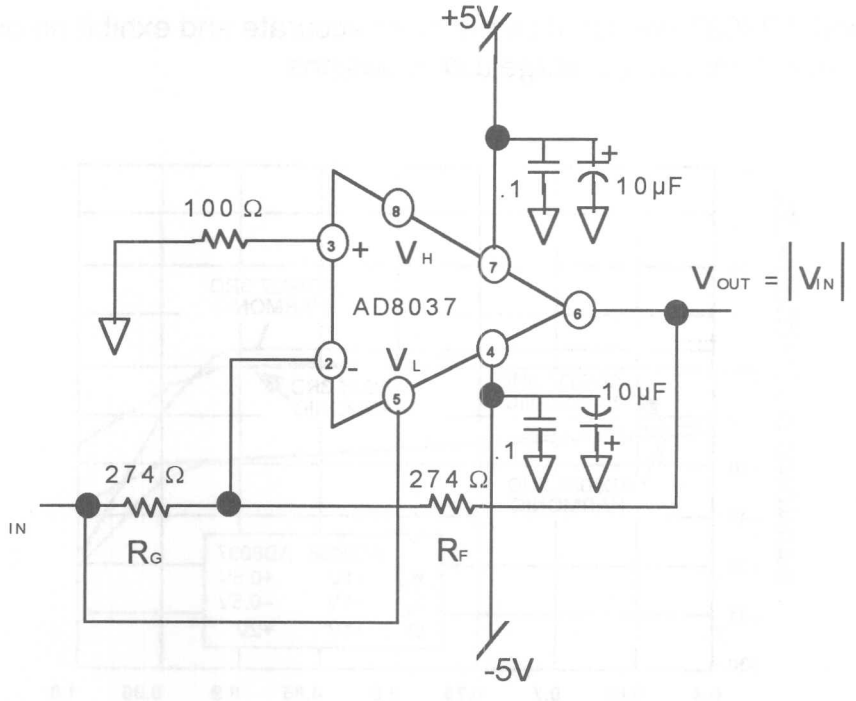


The AD8036 and AD8037 are significantly more accurate and exhibit no overshoot compared to conventional output stage clamp designs.



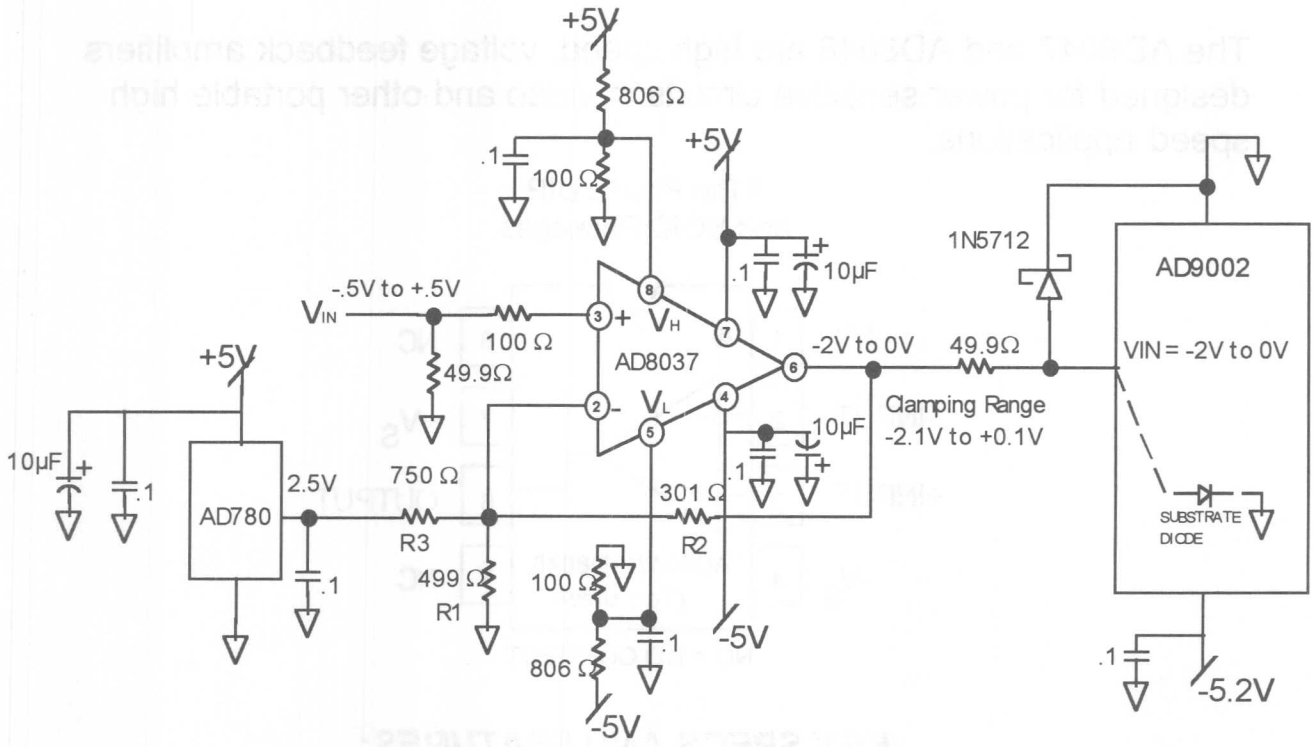
The AD8036 and AD8037 exhibit much lower distortion and nonlinearity than conventional output clamp designs as the input voltage approaches the clamp voltage.





Full-Wave Rectifier

The high speed (240 MHz) of the input clamps allows novel applications such as a full wave rectifier. By using only an AD8037, you can achieve a full wave or half wave (either positive or negative) 20 MHz rectifier.



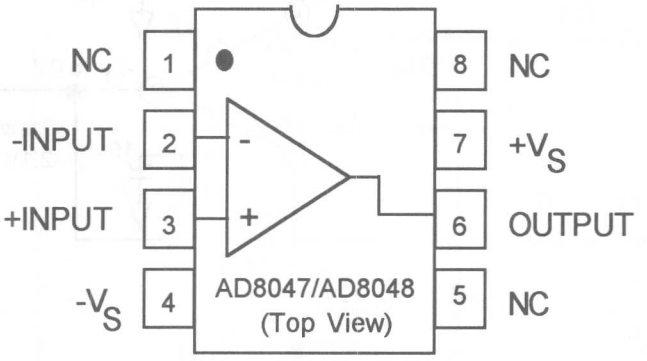
Gain-of-two, Non-inverting with Offset AD8037
Driving an AD9002 — 8-bit, 125 MSPS A/D Converter

The AD8037 Is Used to Accurately Clamp and Drive the Input to a High Speed AD9002 8 Bit, 125 MSPS A/D Converter

AD8047/AD8048
250 MHz, 50 mW, Low Distortion, Voltage Feedback Amplifiers

The AD8047 and AD8048 are high speed, voltage feedback amplifiers designed for power sensitive circuits in video and other portable high speed applications.

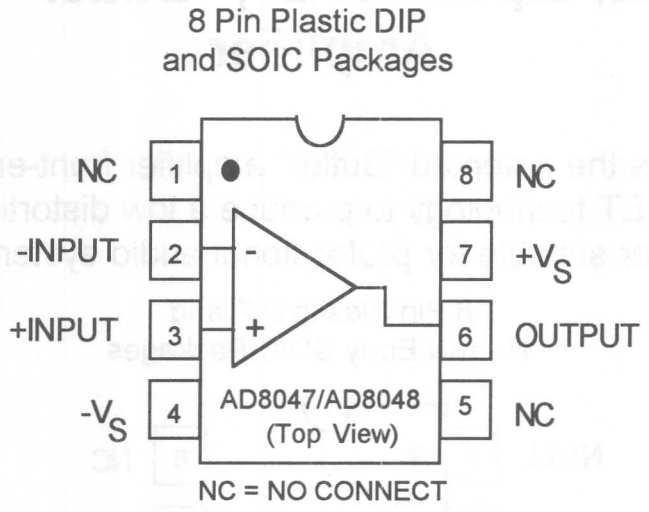
8 Pin Plastic DIP
and SOIC Packages



NC = NO CONNECT

KEY SPECS AND FEATURES:

- Small Signal Bandwidth:
  - » AD8047 : 260 MHz, G = + 1
  - » AD8048 : 250 MHz, G = + 2
- Full Power Bandwidth:
  - » AD8047 : 130 MHz, G = + 1
  - » AD8048 : 150 MHz, G = + 2
- 0.1 dB Gain Flatness
  - » AD8047 : 35 MHz
  - » AD8048 : 50 MHz
- Slew Rate:
  - » AD8047 : 750 V/µs
  - » AD8048 : 1000 V/µs
- Settling Time to 0.1 %: 13 ns, typ
- Low Distortion and Noise
  - » -72 dBc typ @ 5 MHz
  - » -50 dBc typ @ 20 MHz
  - » 4.0 nV / $\sqrt{\text{Hz}}$



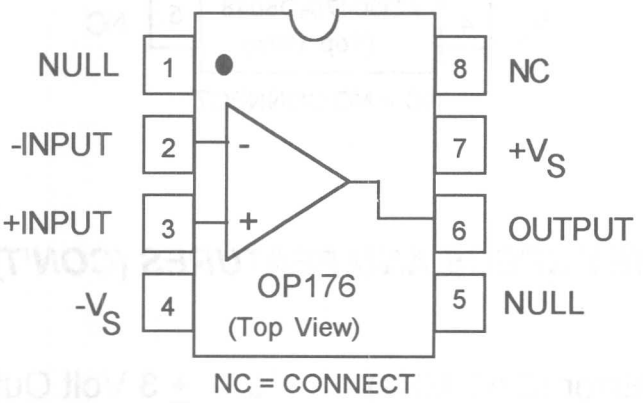
KEY SPECS AND FEATURES (CON'T):

- Differential Gain Error (3.58 MHz)
  - » AD8047 : 0.02 %
  - » AD8048 : 0.01 %
- Differential Phase Error (3.58 MHz)
  - » AD8047 : 0.04 deg
  - » AD8048 : 0.03 deg
- ± 3 Volt Output @ V_S =± 5V Supplies
  - » 50 mA Output Current Drive
  - » Drives 50 pf Load
- Only 5.8 mA Quiescent Current from ± 5V Supplies
- -40 deg C to +85 deg C Operation

OP176
10 MHz, Bipolar/JFET, "Butler" Audio Amplifier

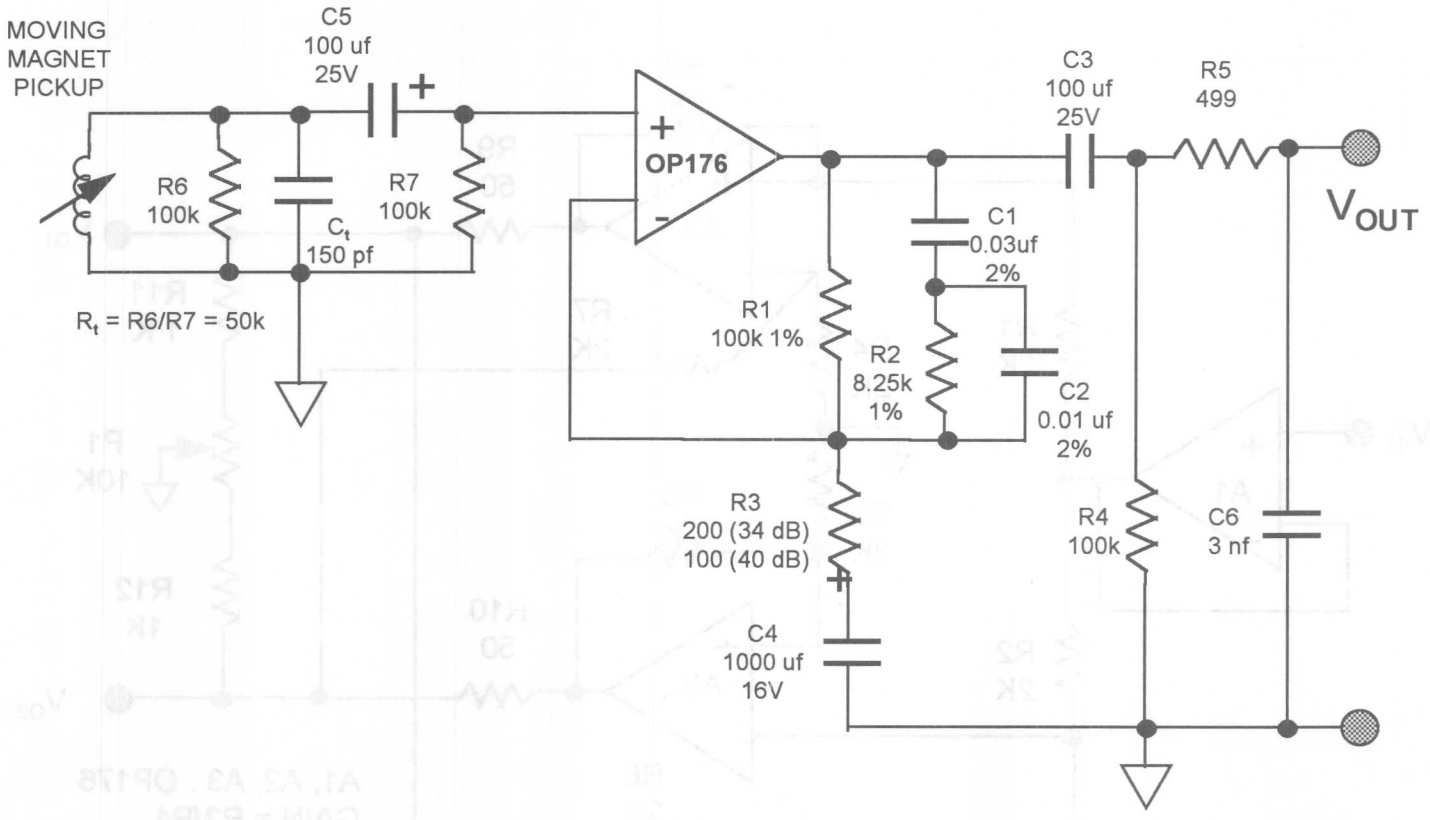
The OP176 features the patented "Butler" amplifier front-end, which combines both bipolar and JFET technology to produce a low distortion, low noise, high output drive amplifier suitable for professional audio systems.

8 Pin Plastic DIP and
Narrow Body SOIC Packages

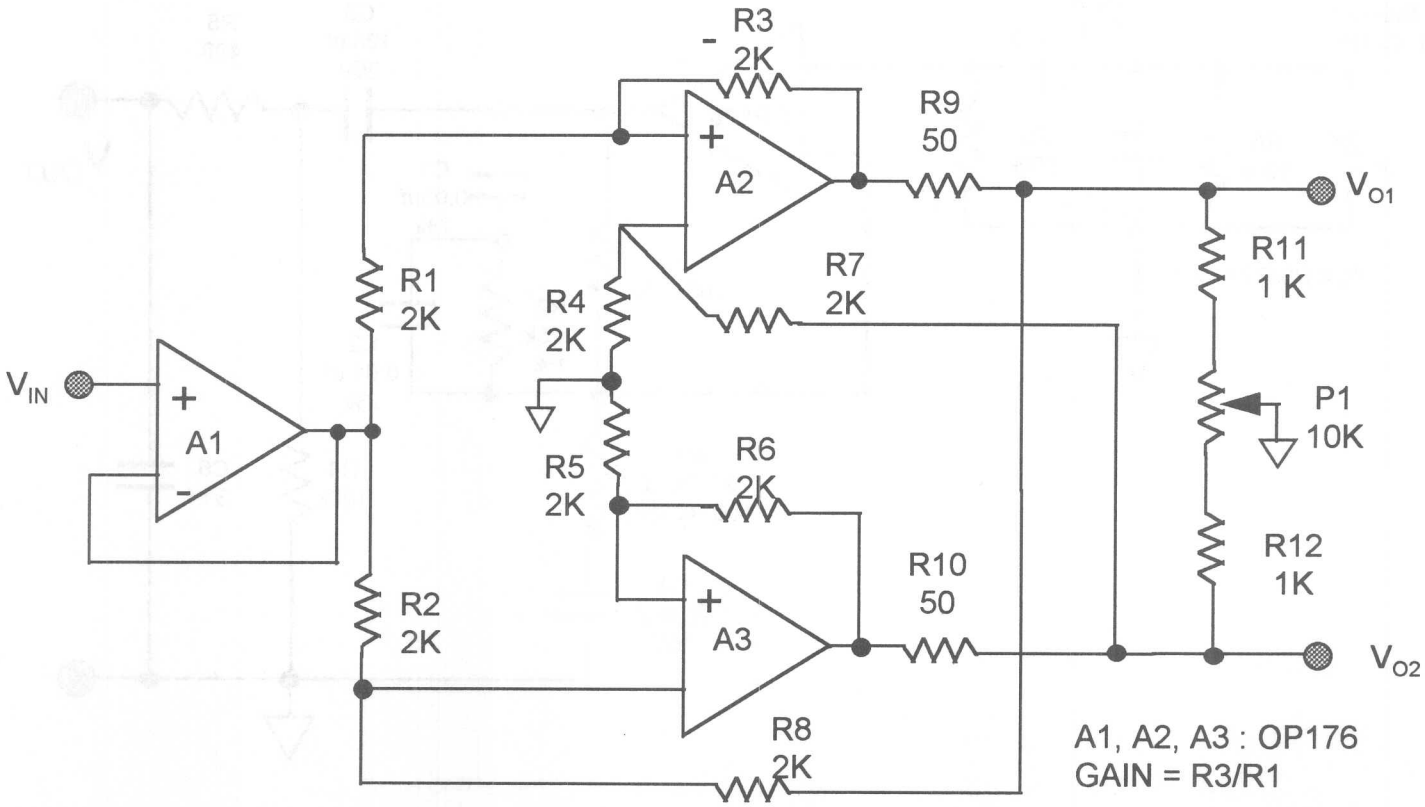


KEY SPECS AND FEATURES:

- Dynamic Performance:
  - » 10 MHz Bandwidth
  - » 25 V/µs Slew Rate
- Audio Quality Performance:
  - » Total Harmonic Distortion & Noise : 0.001 %
  - » Capable of Driving 10 V rms into 600 ohms
- Excellent DC Specs:
  - » Input Offset Typically 200 uV
  - » Offset Stability Typically 5 uV/deg C
- Quiescent Current Only 2.5 mA
- Unity Gain Stable
- -40 deg C to +85 deg C Operation



An RIAA Phono Preamplifier Circuit

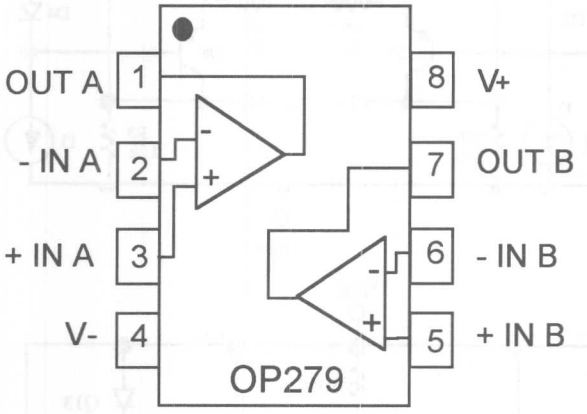


A High Speed, Low Noise Differential Line Driver

OP279
5V, 5 MHz, High Output Current, Rail-Rail Amplifier

The OP279 is a high speed, high output current dual, rail-rail amplifier optimized for use as a low distortion driver for modem transformers or multi-media headphones

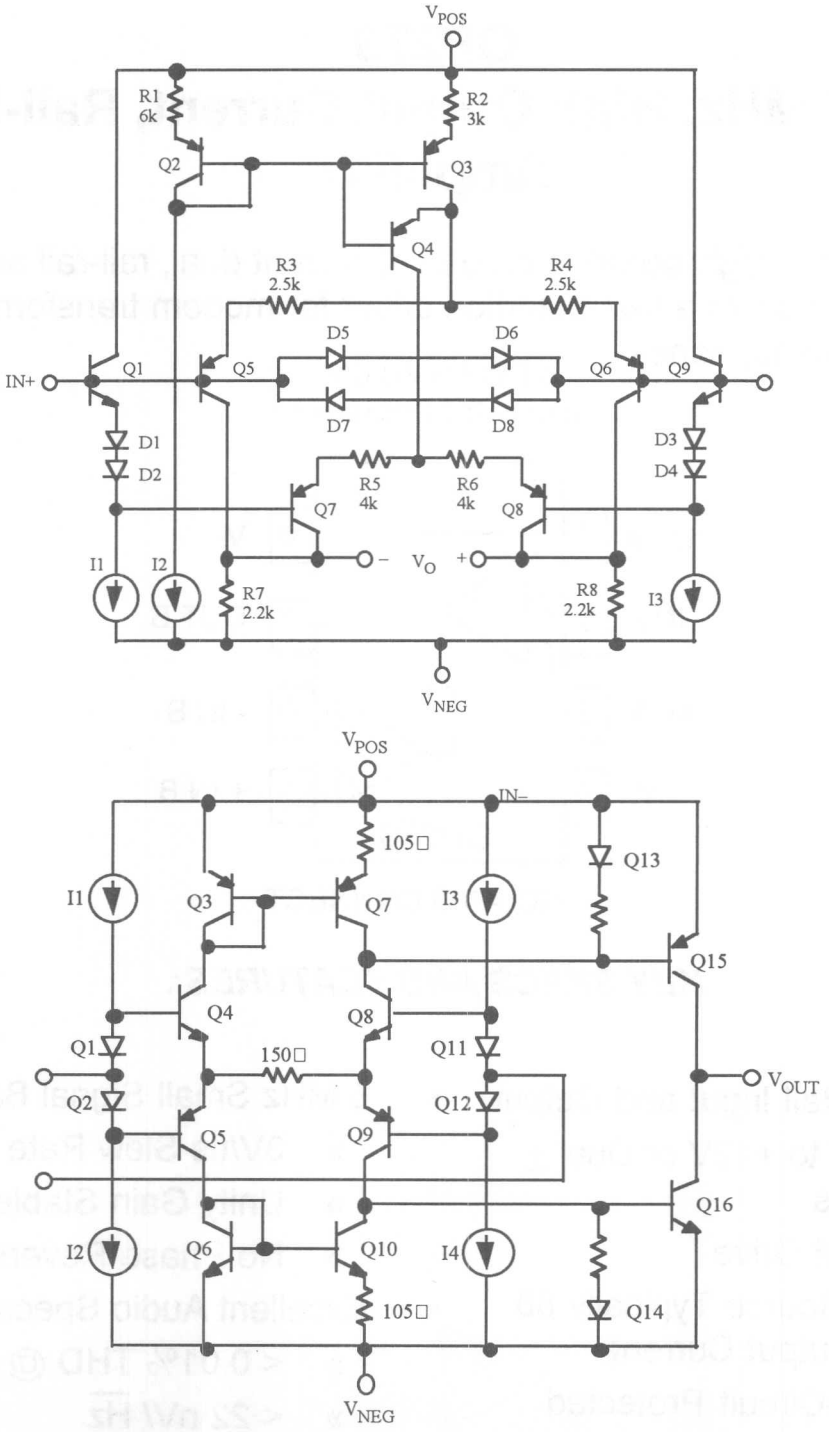
8 Pin Plastic DIP
and SOIC Packages



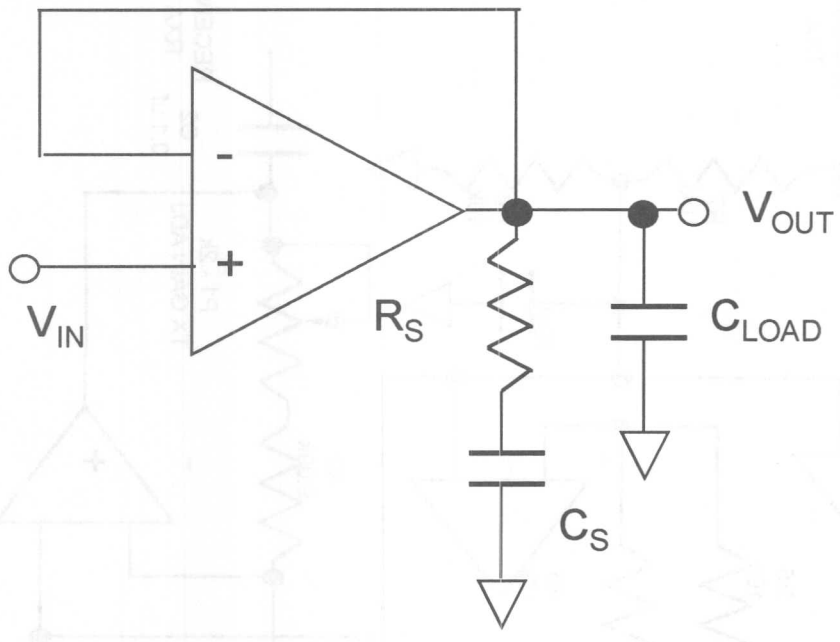
NC = NO CONNECT

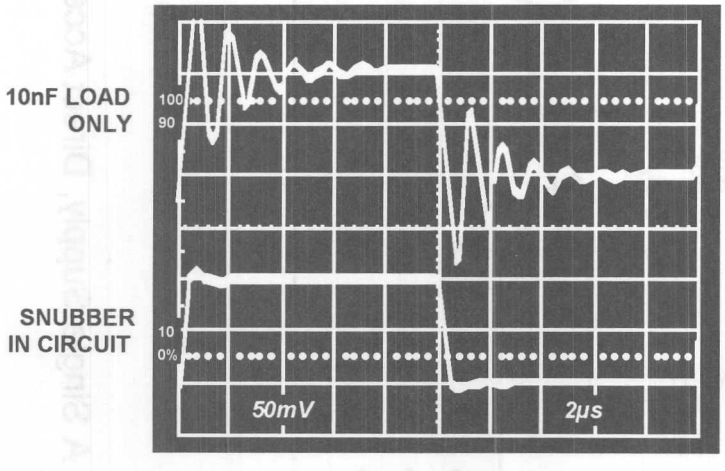
KEY SPECS AND FEATURES:.

- True Rail-Rail Input and Output
- Single +5V to +12V or Dual ± 5V Supplies
- High Output Drive
  - » Sink/Source Typically 80 mA Output Current
  - » Short-Circuit Protected
  - » Drives up to 10 nf Loads
- 5 MHz Small Signal Bandwidth
  - » 3V/us Slew Rate
  - » Unity Gain Stable
  - » No Phase Reversal
- Excellent Audio Specs (600 Ω)
  - » < 0.01% THD @ 1 kHz
  - » < 22 nV/ $\overline{\text{Hz}}$
- -40 deg C to + 85 deg C Operation



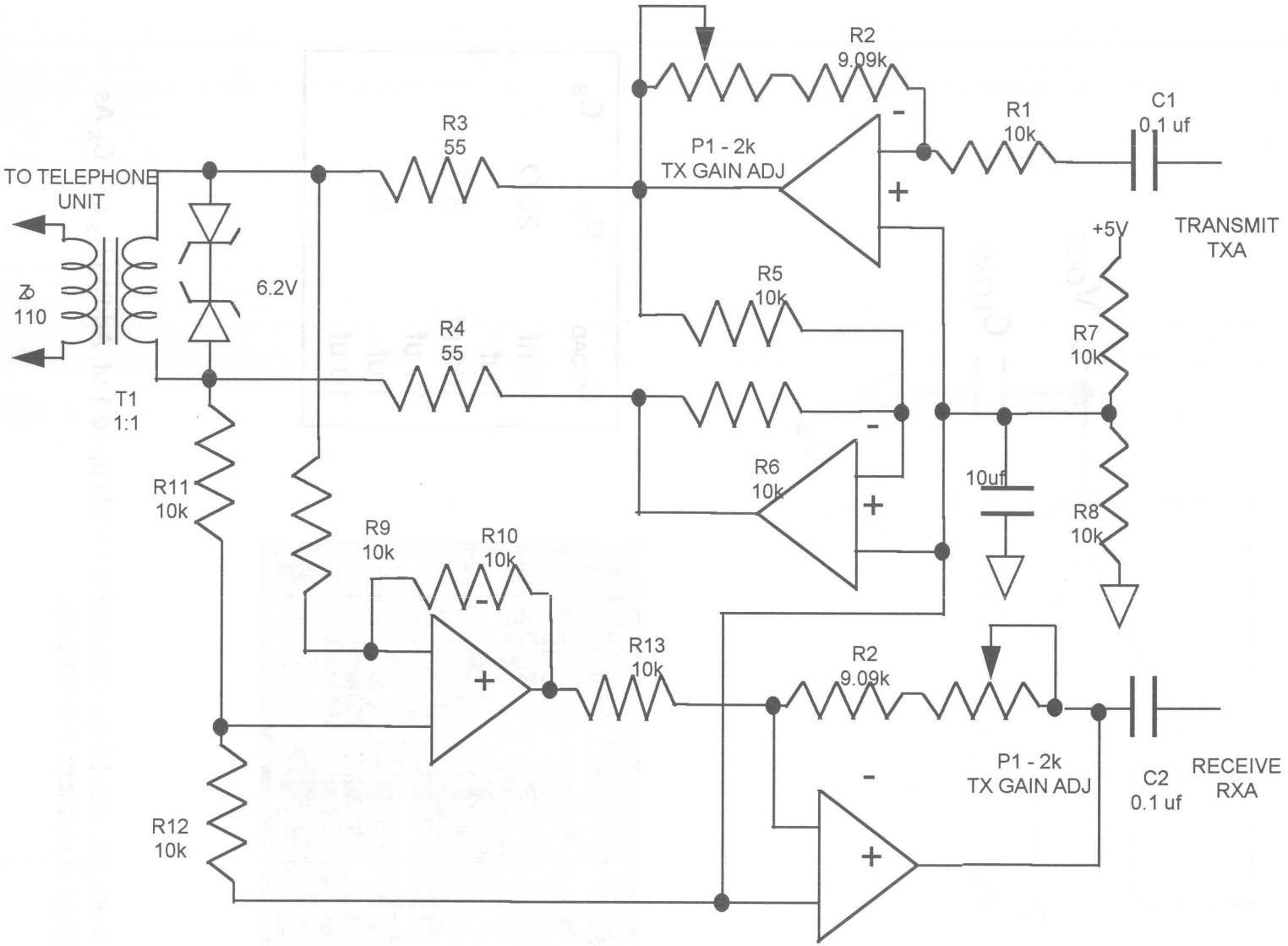
True Rail-Rail Performance Is Achieved by the OP279'S Unique Input (top) and Output (bottom) Stage Architecture.





C_{LOAD}	R_S	C_S
10 nf	20 Ω	
1 uf		
100 nf	5 Ω	
10 uf		
1 uf	0 Ω	
10 uf		

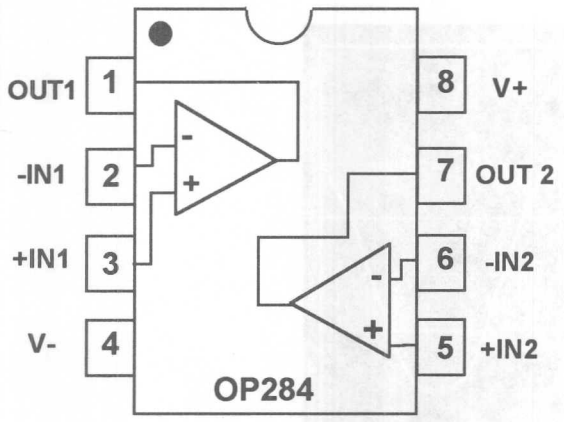
The OP279 Easily Drives Large Capacitive Loads up to 1 uf. Adding R_S and C_S As Shown Reduces Overshoot and Ringing.



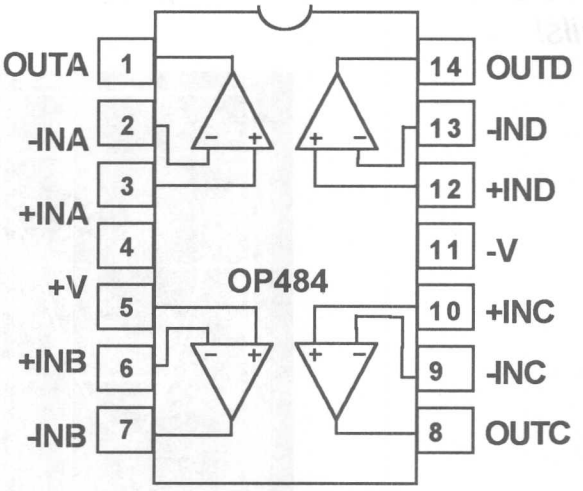
A Single Supply, Direct Access Arrangement for Modems

OP284/OP484*
+3V, 5 MHz, Dual/Quad, Low Noise, Rail-Rail Amplifiers

The OP284 and OP484 are high speed, low noise amplifiers that operate from a single +3V supply!



8 LEAD DIP AND NARROW BODY SOIC



14 LEAD DIP, SOIC AND XXXXX

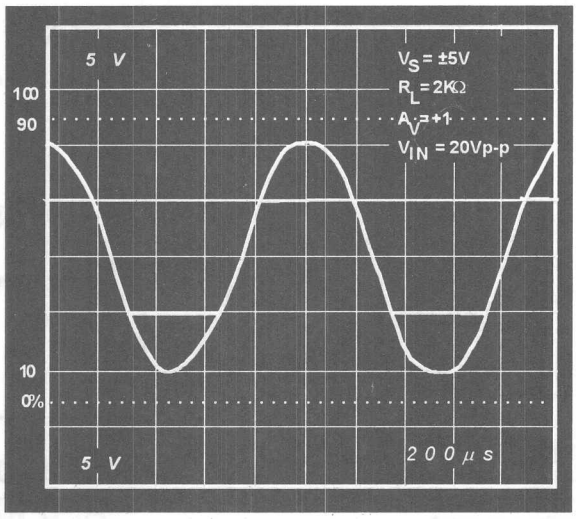
KEY SPECS AND FEATURES:

- True Rail-Rail Input and Output
- Wide Bandwidth : 4 MHz
- High Slew Rate : 3V/us
- Unity Gain Stable
- Low Offset Voltage : 50 uV
- Low Noise : 3.9 nV/ $\sqrt{Hz}$
- Single (+3V to +30V) or Dual ($\pm$ 1.5V to $\pm$ 15V) Operation
- New ***HOT*** Industrial Temperature Range : - 40 deg C to + 125 deg C

**Preliminary Technical Information*

OP191/OP291/OP491
+3V, 3 MHz, Single/Dual/Quad Rail-Rail Amplifiers

The OP191/OP291/OP491 are single/dual/quad true, input and output rail-rail amplifiers. A unique input stage prevents latch-up and phase reversal, *even when the inputs are overdriven by 5 volts beyond the rails!*

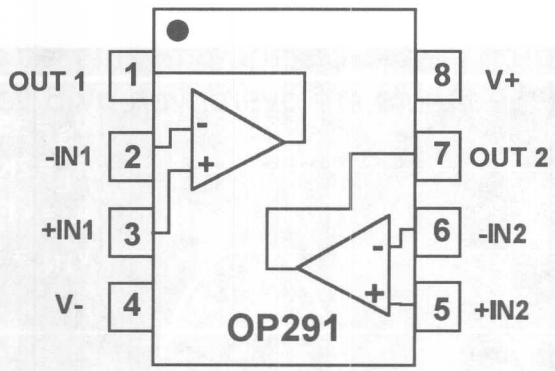


KEY SPECS AND FEATURES:

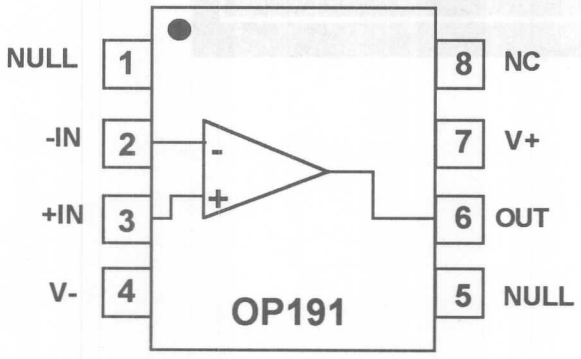
- Input and Output Voltages Swing Rail-Rail:
  - » No Latch-up or Phase Reversal
- + 3V to ± 5V Supply Operation
  - » Only 300 uA Quiescent Current Per Amplifier
- 3 MHz Small Signal Bandwidth
- Low DC Offset Voltage : 700 uV
- Output Sinks and Sources Current Up to

  the Supply Rails
- New ***HOT*** Industrial Temperature Range: - 40 deg C to + 125 deg C

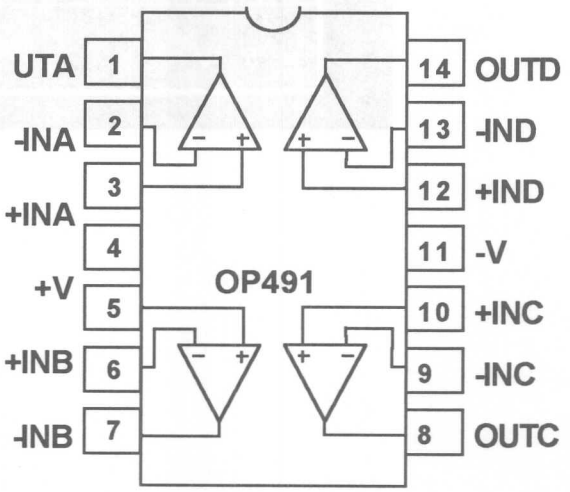
8 LEAD DIP
AND
NARROW BODY SOIC

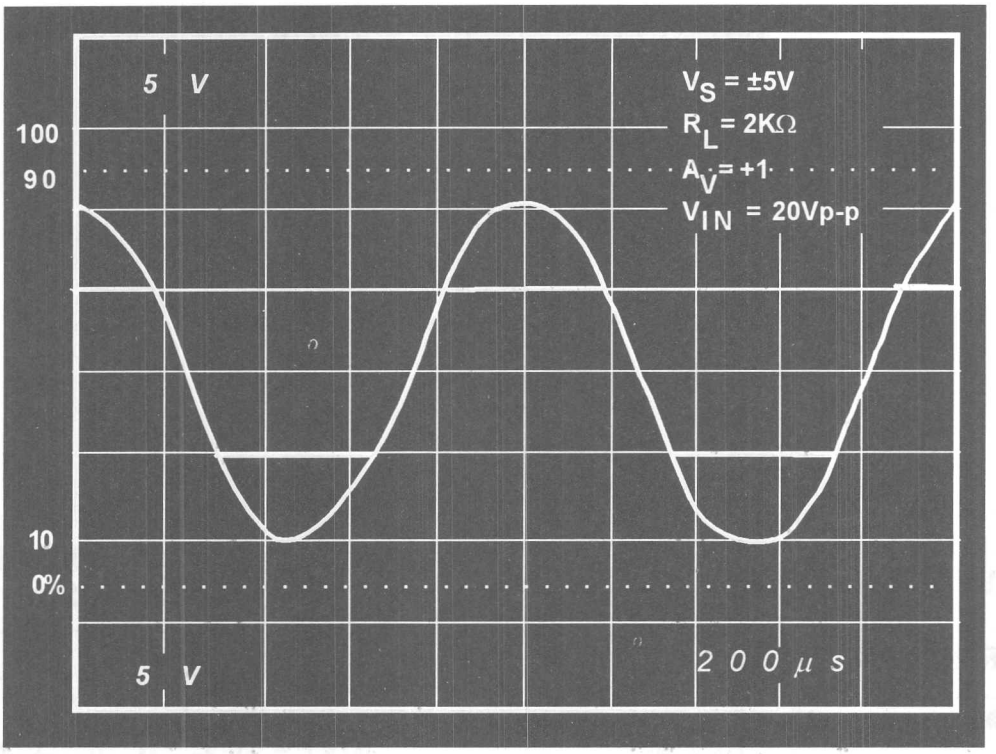


8 LEAD EPOXY DIP
AND
NARROW BODY SOIC

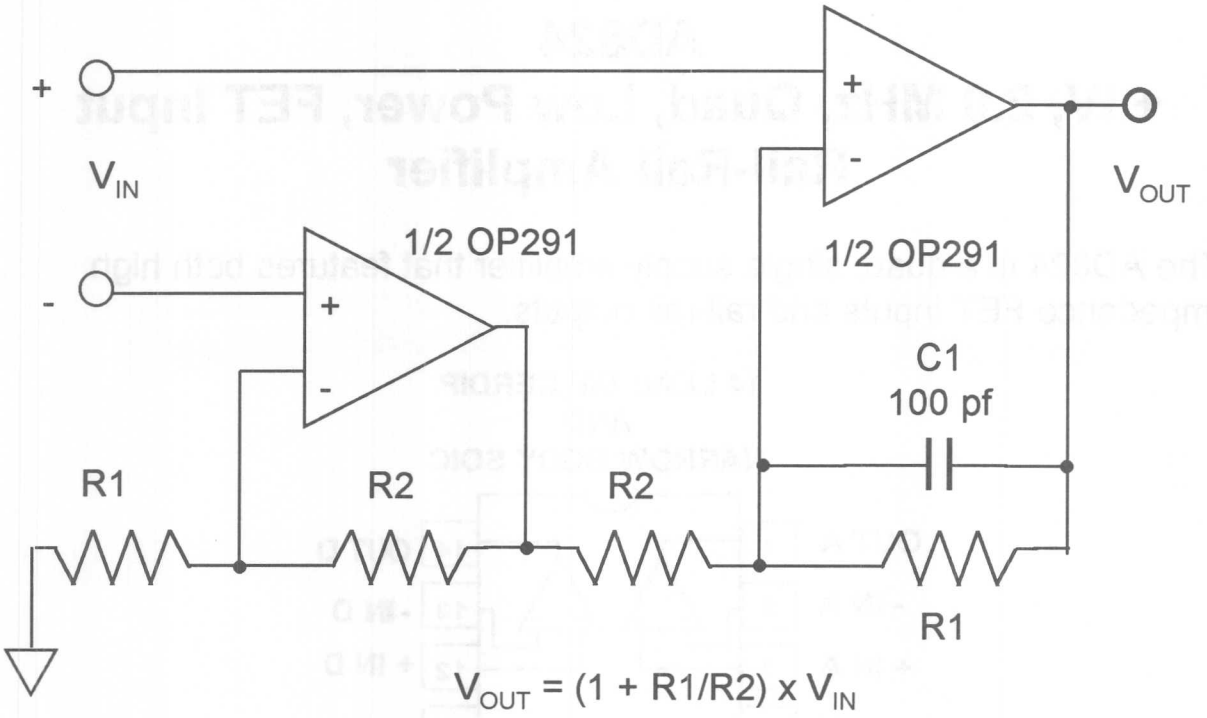


14 LEAD DIP,
NARROW BODY SOIC
AND TSSOP

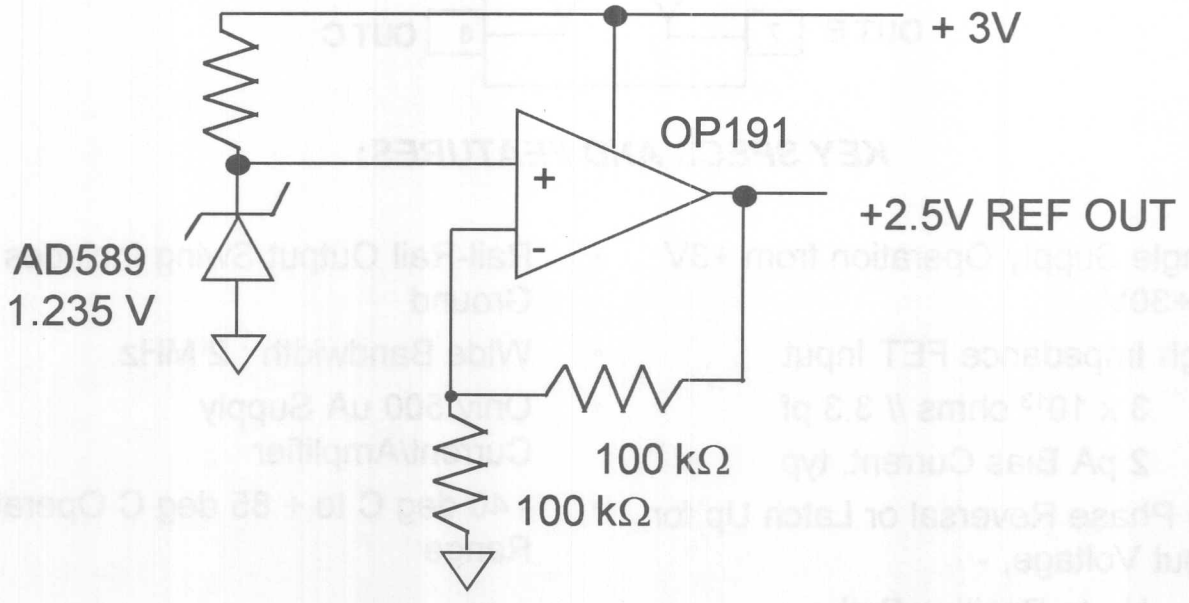




The Inputs to the OP191, OP291 and OP491 may be overdriven up to 5 volts beyond the supply rails, with no latch-up or phase reversal at the output.



A Single +3V Supply Instrumentation Amplifier

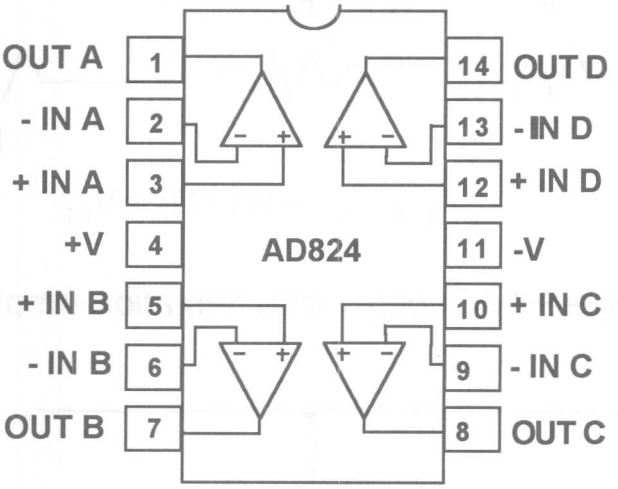


A Stable, Low Drift, +2.5 Volt Reference From a Single, +3 Volt Supply

AD824
+3V, 2.0 MHz, Quad, Low Power, FET Input Rail-Rail Amplifier

The AD824 is a quad, single supply amplifier that features both high impedance FET inputs and rail-rail outputs.

14 LEAD DIP,CERDIP AND NARROW BODY SOIC

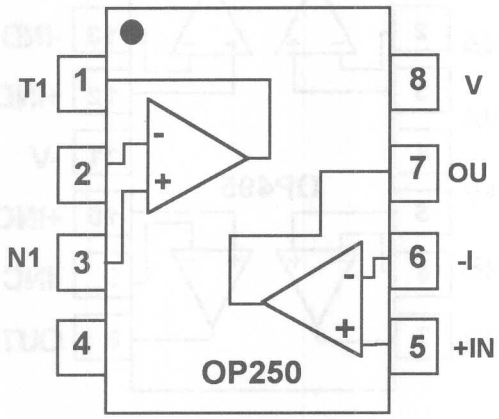


KEY SPECS AND FEATURES:

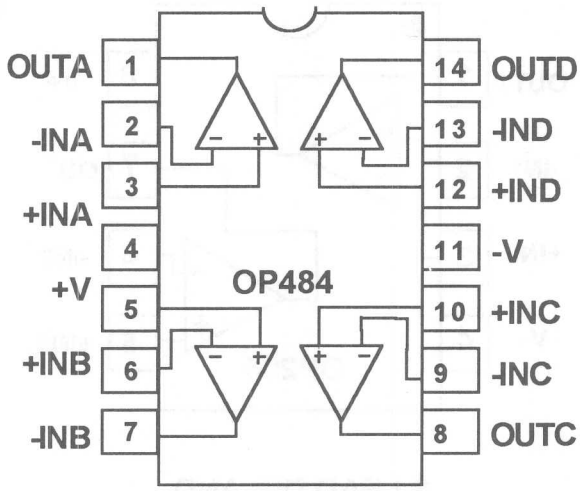
- Single Supply Operation from +3V to +30V
- High Impedance FET Input
  - » 3 x 10^{13} ohms // 3.3 pf
  - » 2 pA Bias Current, typ
- No Phase Reversal or Latch Up for Input Voltage, -
  - » Up to Positive Rail
  - » Beyond Negative Rail
- Rail-Rail Output Swing Includes Ground
- Wide Bandwidth : 2 MHz
- Only 500 uA Supply Current/Amplifier
- - 40 deg C to + 85 deg C Operating Range

OP250/OP450*
+3V, 1 MHz, Dual/Quad CMOS Rail-Rail Amplifiers

The OP250 and OP450 are similar in performance to our OP291 and OP491. They are designed primarily for low power applications where very low bias current is required.



8 LEAD DIP AND NARROW BODY SOIC



14 LEAD DIP, NARROW BODY SOIC AND TSSOP PACKAGES

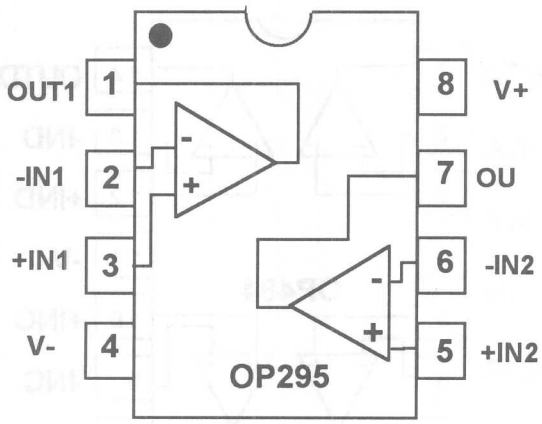
KEY SPECS AND FEATURES:

- Single Supply Operation from +3V to +12V
- 500 uA Quiescent Current/Amp
- Low Input Bias Current : 60 pA max
- Wide Bandwidth : 1.4 MHz
- No Phase Reversal
- Output Current : ± 25 mA
- New ***HOT*** Industrial Temperature Range : -40 deg C to + 125 deg C

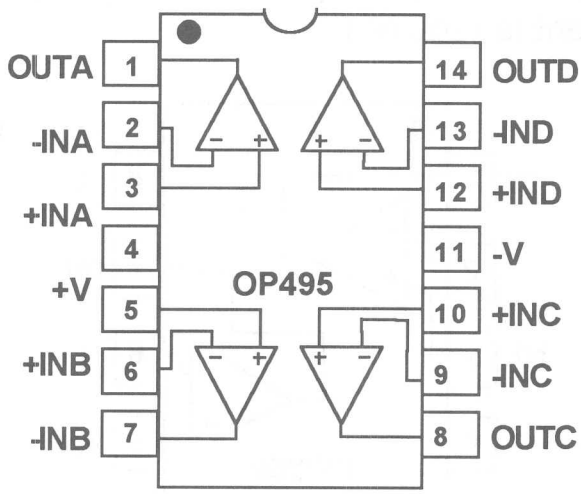
**Preliminary Technical Information*

OP295/OP495*
+3V, 1 MHz, Dual/Quad, Low Power Rail-Rail Amplifiers

The OP295 and OP495 feature high DC accuracy, low noise and rail-rail output swing.



8 LEAD DIP AND NARROW BODY SOIC



14 LEAD DIP AND 16 LEAD, 300 MIL SOIC PACKAGE (PINS 8 & 9 ARE NC)

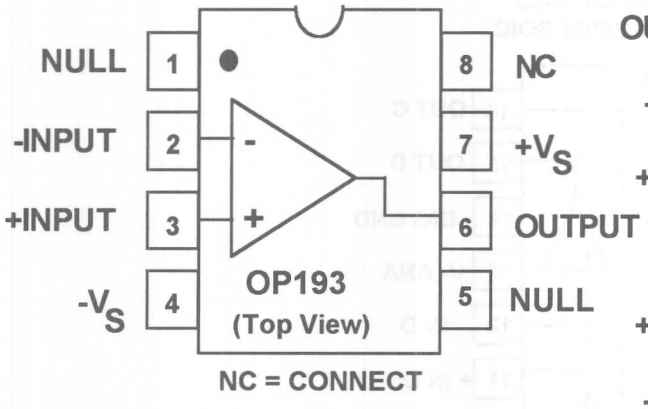
KEY SPECS AND FEATURES:

- Input Offset : 30 uV typ, 300 uV max
- Offset Drift : 1 uV/deg C, typ
- High Open Loop Gain :10,000 V/mV
- 75 kHz Gain Bandwidth Product
- Unity Gain Stable
- Single Supply Operation : +3V to +36V
- 150 uA Supply Current/Amplifier
- Rail-Rail Output Swing
  - » ± 15 mA Output Current
  - » Can Drive up to 300 pf
- New ***HOT*** Industrial Temp Range : -40 deg C to + 125 deg C

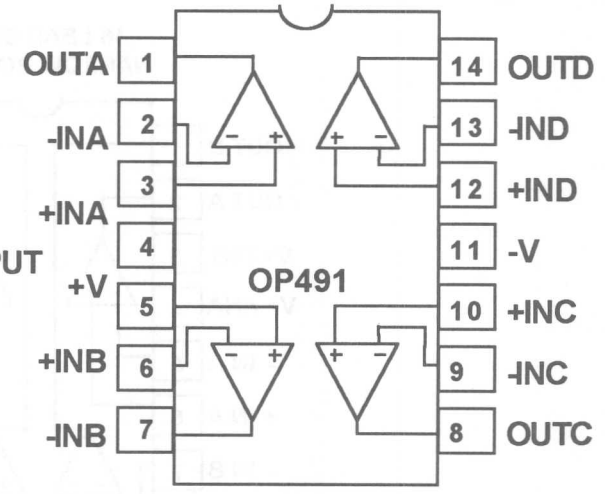
**Preliminary Technical Information*

OP193/OP293/OP493*
+3V, Single/Dual/Quad, Micropower Rail-Rail Amplifiers

The OP193, OP293 and OP493 are next generation updates to our popular OP90 Micropower Series



OP193, OP293:
8 Pin Plastic DIPand Narrow Body SOIC Packages



14 Lead DIP and SOIC

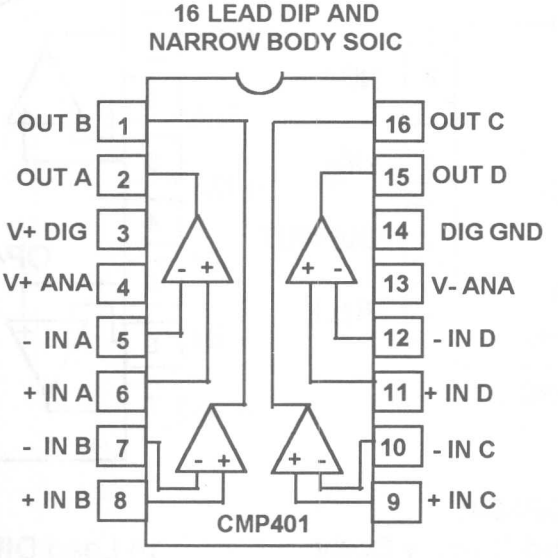
KEY SPECS AND FEATURES:

- Performance Specified for +3V to ±15V Supply Operation
- Draws Only 15 uA per Amplifier!
- Excellent DC Performance
  - Low DC Offset : 75 uV, max
  - Drift : 0.8 uV/deg C max
  - Open Loop Gain 700 V/mV
- Unity Gain Stable
- No Phase Reversal
- Output Sinks and Sources 8 mA
- -40 deg C to +85 deg C Operating Range

**Preliminary Technical Information*

CMP201/CMP401*
High Speed, Low Power, Dual/Quad Comparator

The CMP201 and CMP401 are high speed, 20 ns comparators with independent input and output supplies to allow flexibility in interfacing to various logic families.



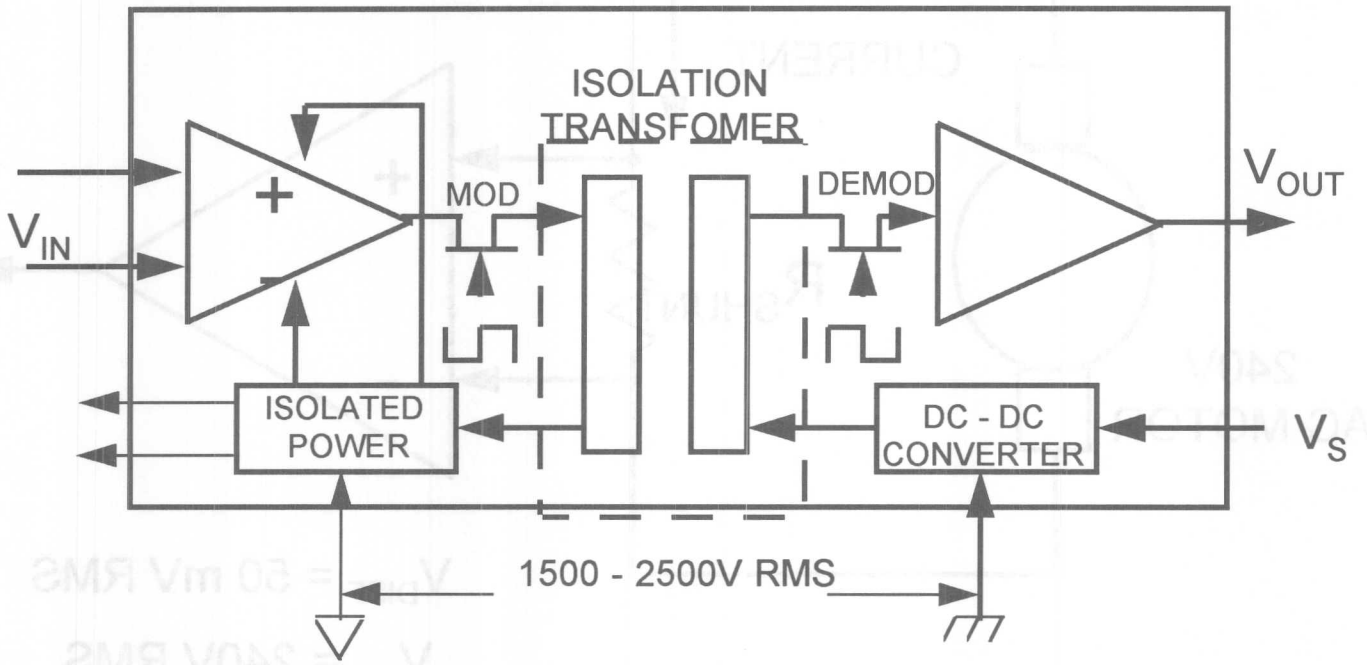
KEY SPECS AND FEATURES:

- 15 ns Propagation Delay
- +3V to ± 5V Operation
- 1.3 mA Quiescent Current
- Separate Connections for Input and Output Power Supplies
- Signal Voltage Gain :10,000V/mV
- New ***HOT*** Industrial Temperature Range : -40 deg C to + 125 deg C

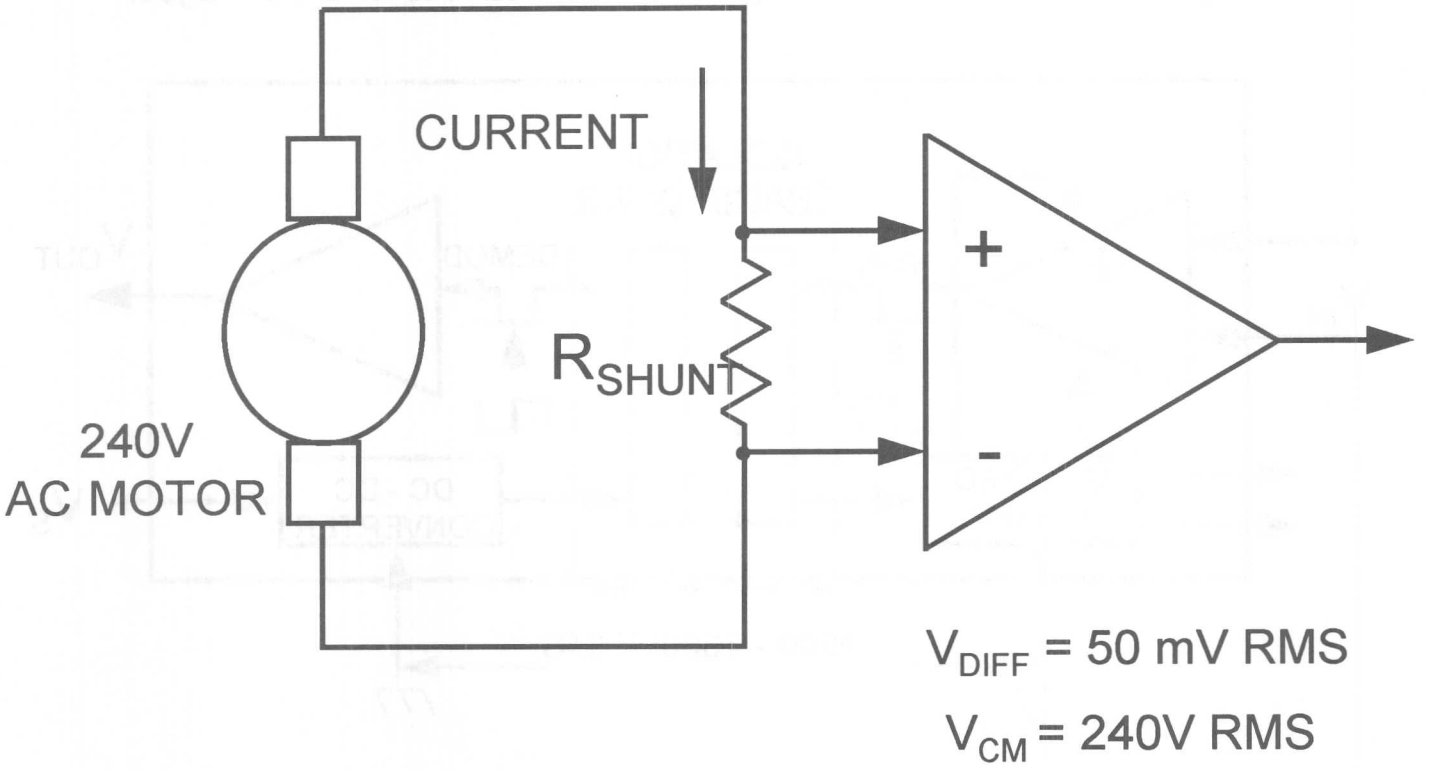
**Preliminary Technical Information*

AD102/AD104
Low Cost Isolation Amplifiers

The AD102 and AD104 are cost-effective solutions to monitoring low level AC or DC signals in the presence of high common mode AC or DC voltages.



- 500V rms Continuous CMV Isolation Between Input-Output
- Fully Self-Contained - Requires No External DC-DC Converter:
  - » AD102 Requires Only Single + 15V Supply
  - » AD104 Uses Ext Sync Clock for Multi-Channel Applications
- 0.05 % Max Nonlinearity
- Small Signal Bandwidth:
  - » AD102: 1.5 kHz
  - » AD104: 4 kHz
- ± 5V Input/Output Range
- User-Configurable Input Amplifier Stage
- Small SIP-Style Package : 2.08" x 0.25" x 0.625"
- -40 deg C to +85 deg C Operating Range



An *Isolation Amplifier* is capable of measuring small AC or DC voltages in the presence of high common mode voltages. A typical application for the AD102 or AD104 Isolation Amplifier is the measurement of AC motor current. The 50 mV developed across the shunt resistor can be accurately measured despite the 240V of common mode.

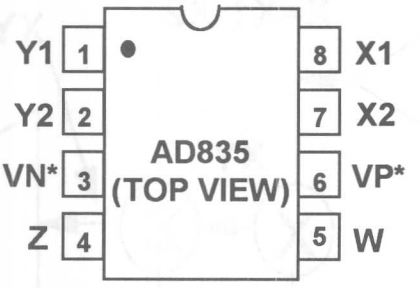
SECTION 2
ANALOG SIGNAL PROCESSING

High Frequency 4-Quadrant Multipliers
Demodulating Logarithmic Amplifiers
RGB to NTSC/PAL Encoders

AD835
250 MHz, Voltage Output, 4-Quadrant Multiplier

The AD835 is the Industry's first monolithic, 250 MHz, 4-quadrant, *voltage output* Multiplier!

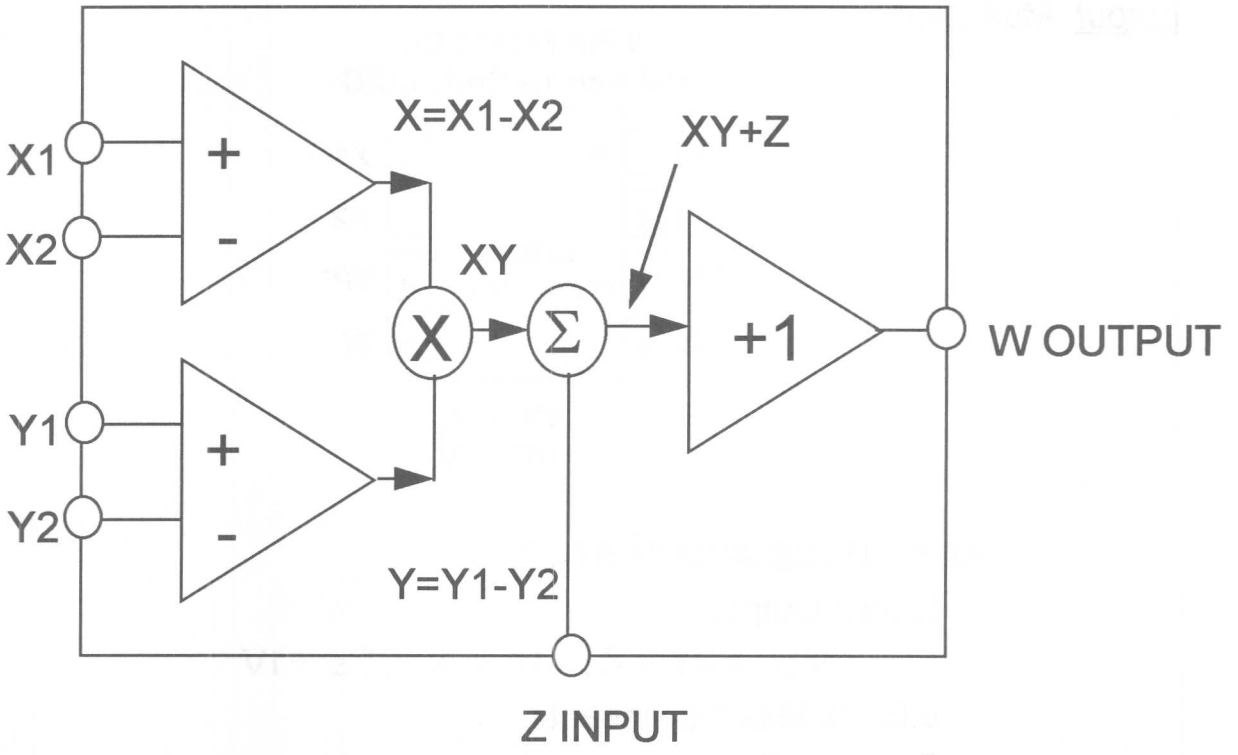
8 Pin Plastic DIP
and Narrow Body SOIC



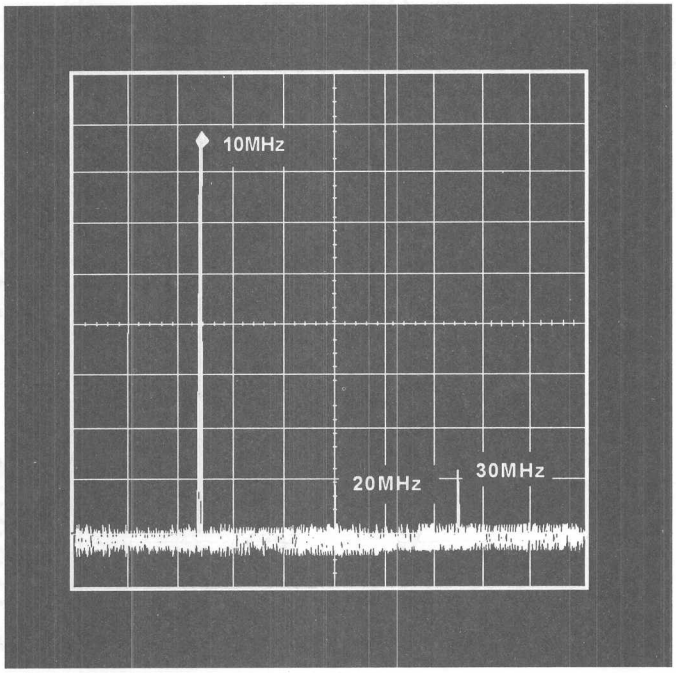
*** VN = $-V_S$**
VP = $+V_S$

KEY SPECS AND FEATURES:

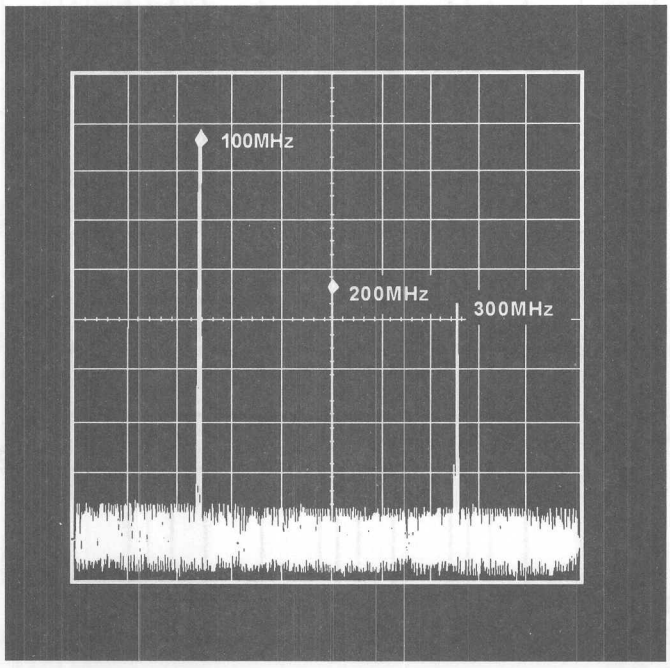
- Linear Output:
  - $V_{out} = XY + Z$; $-1V \leq X,Y,Z \leq +1V$
- 0.03 % Max Nonlinearity
- Dynamic Performance:
  - 250 MHz Small Signal (-3 dB) Bandwidth
  - 0.1 dB Gain Flatness to 15 MHz
  - 1000V/µs Slew Rate
  - Settles to 0.1% Full Scale in 20 ns
- Simple to Use: Requires Minimal External Components
- Low Noise Performance: 50 nV/√ Hz
- High Output Drive: ± 2.0V into 50 ohms
- ± 5V Supply Operation
- -40 deg C to +85 deg C Operating Range



AD835 Simplified Block Diagram

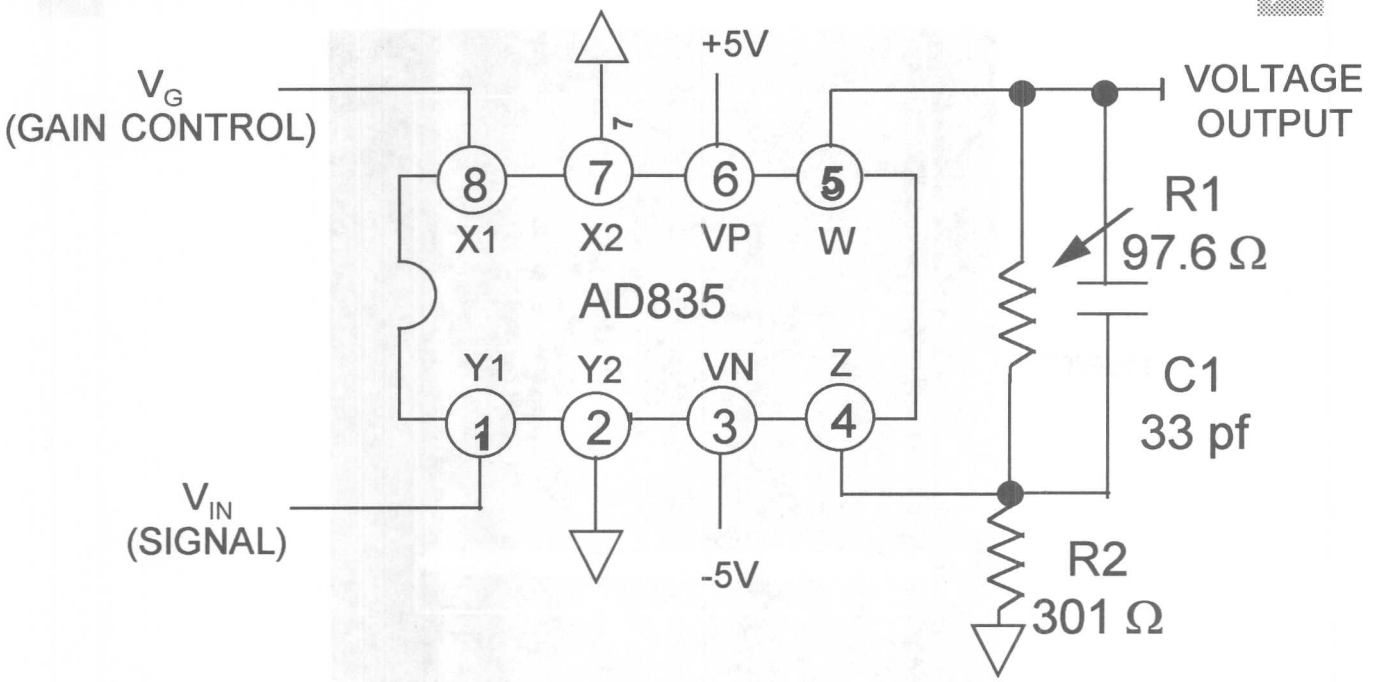


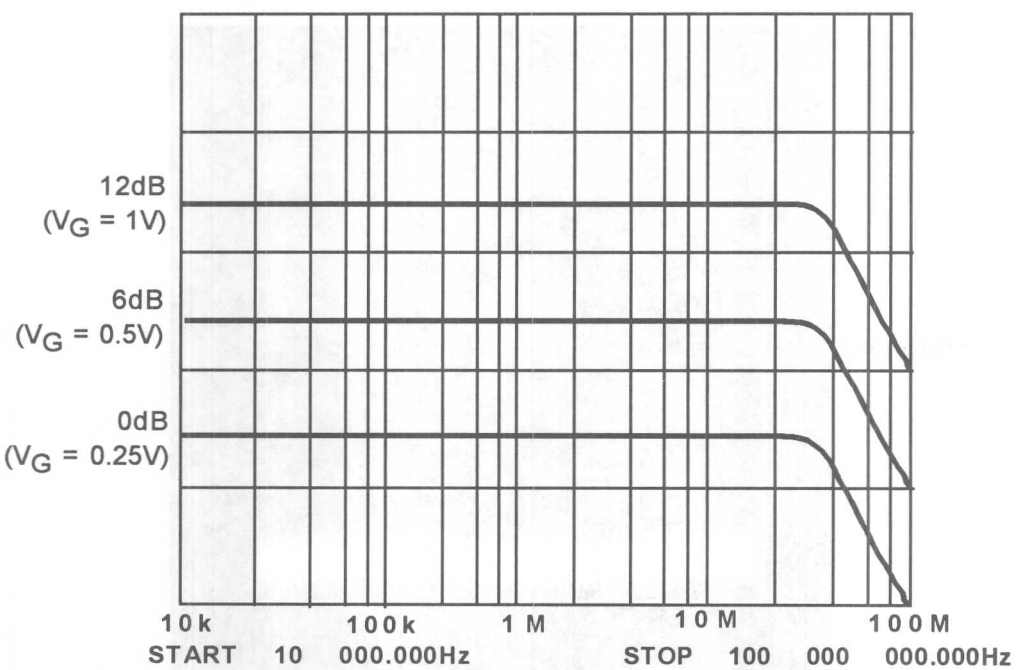
10dB/DIV



10dB/DIV

AD835 harmonic distortion at 10 MHz and 100 MHz with 10 dBm input to X or Y channels, and R_L = 150 Ω and $C_L \leq 5$ pF.





A 50 MHz, Voltage-Controlled Amplifier Using the AD835, and the AC Response of the 50 MHz VCA Shown Above.

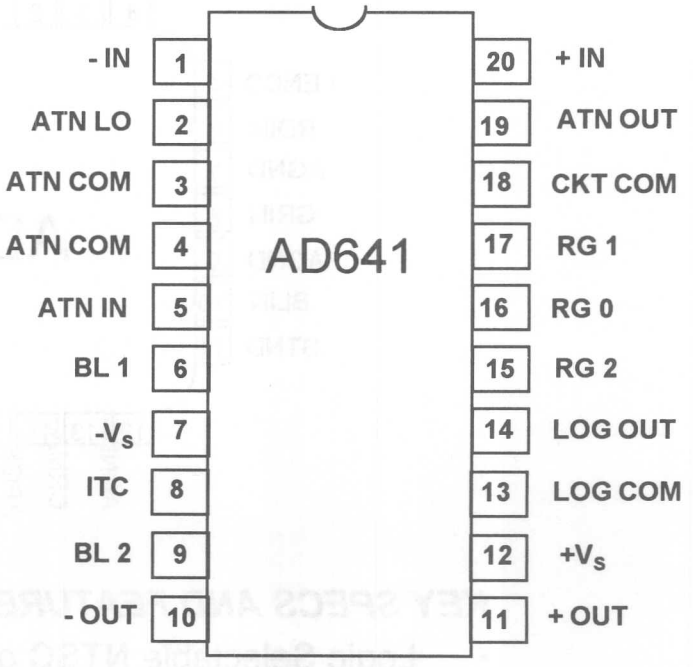
AD641*
250 MHz, Demodulating Logarithmic Amplifier

The AD641 is a high performance,low cost monolithic solution designed for applications such as signal power measurement at high IF in ECM/Radar, communications and instrumentation.

KEY SPECS AND FEATURES:

- Wide Bandwidth : 250 MHz
- 45 dB Dynamic Range
- ± 2.5 dB Log Conformance
- 37.5 mV/dB Output
- 2.5 nV/Hz Input Noise, 1 kHz - 1 MHz
- On Board 10x Input Attenuator
- Dual Polarity Current Outputs
- Direct Coupled Differential Signal Path
- Low Power Operation
  - » ± 5V Supplies
  - » 9 mA, $+V_S$, 35 mA, $-V_S$
- -40 deg C to +85 deg C (Plastic DIP and PLCC) and -55 deg C to +125 deg C (CerDIP) Operation

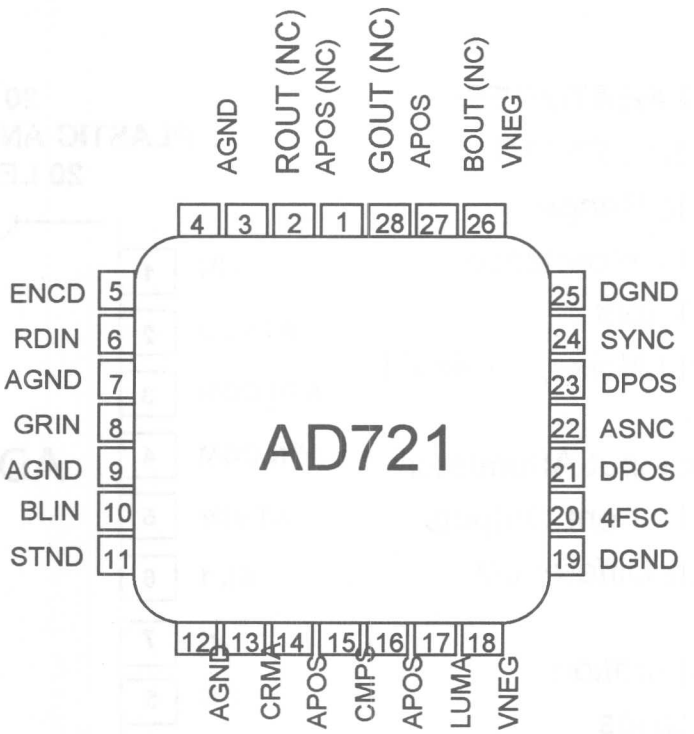
20 LEAD
PLASTIC AND CERAMIC DIP,
20 LEAD PLCC



**Preliminary Technical Information*

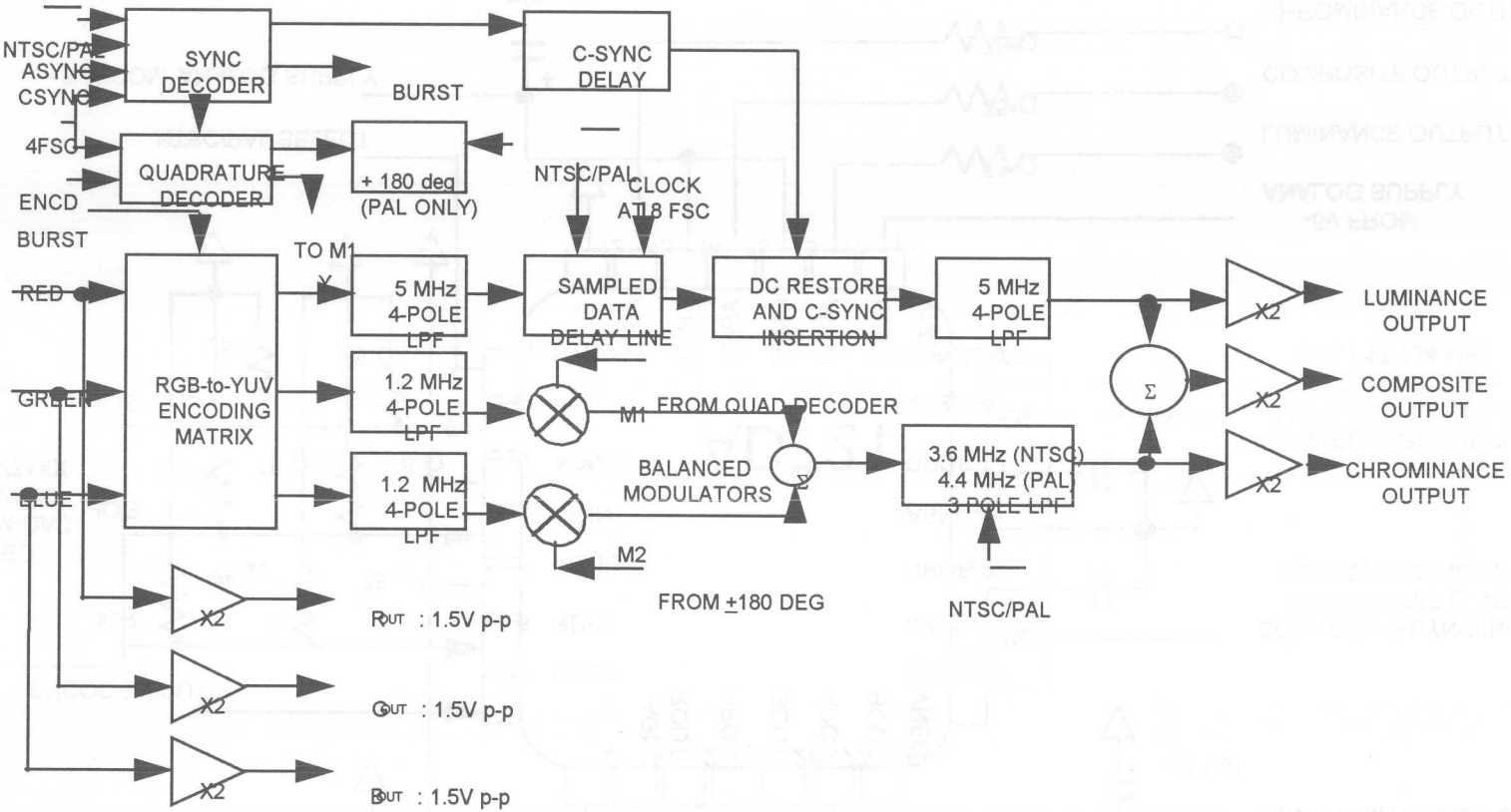
AD721
RGB to NTSC/PAL Encoder

The AD721 is a fully integrated, low cost, monolithic solution for converting red, green and blue (RGB) component video signals into standard NTSC or PAL luminance (brightness), chrominance (color) and composite baseband video signals. The AD721 additionally features a by-pass mode for the RGB signals to directly drive 75 ohm reverse-terminated cables.

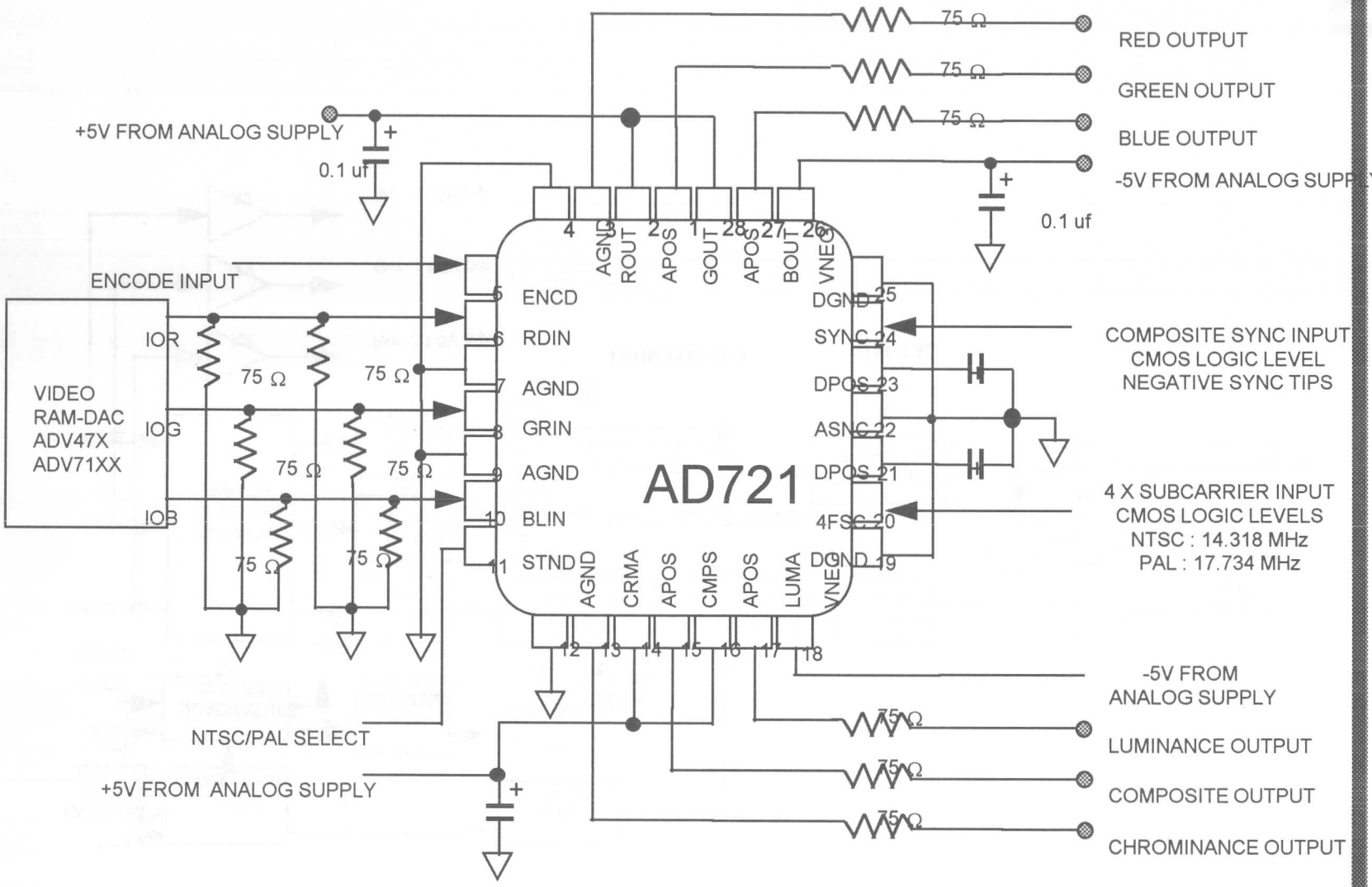


KEY SPECS AND FEATURES:

- Logic Selectable NTSC or PAL Encoding Modes
- Drives 75 ohm Reverse Terminated Loads
- No External Filters or Delay Lines Required
- Logic Selectable By-Pass Mode
- Low Power Operation : ± 5V Supplies, 200 mW
- 0 deg C to 70 deg C Operation



AD721 Functional Block Diagram

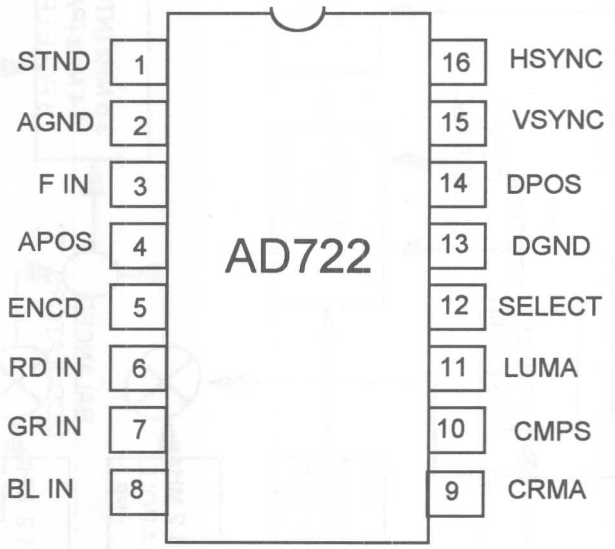


Typical Application Circuit for the AD721

AD722*
Low Cost, RGB to NTSC/PAL Encoder

The AD722 is a lower cost version of our high performance AD720 and AD721 RGB-to-NTSC/PAL Encoders, with the following enhancements:

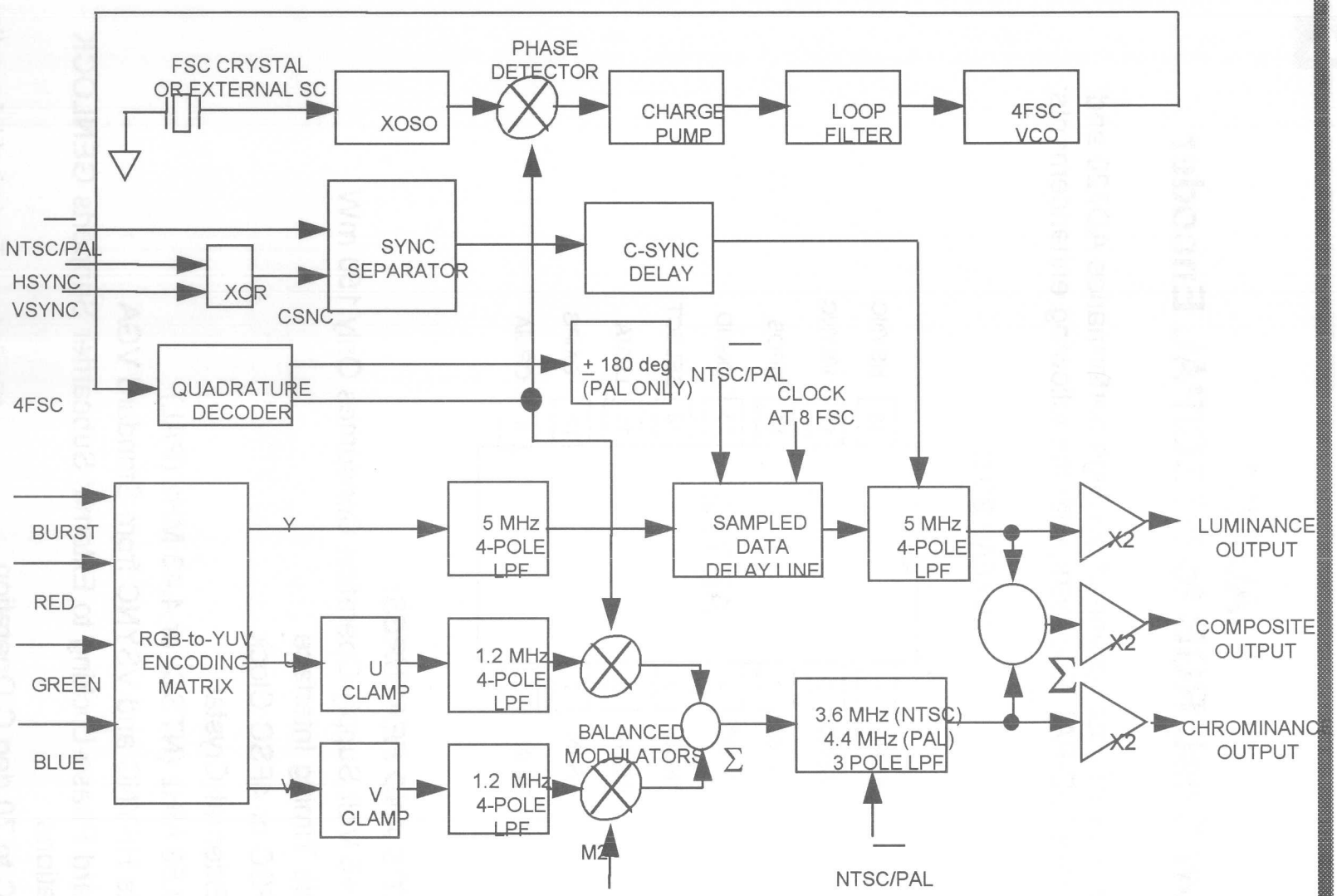
16 LEAD SOIC



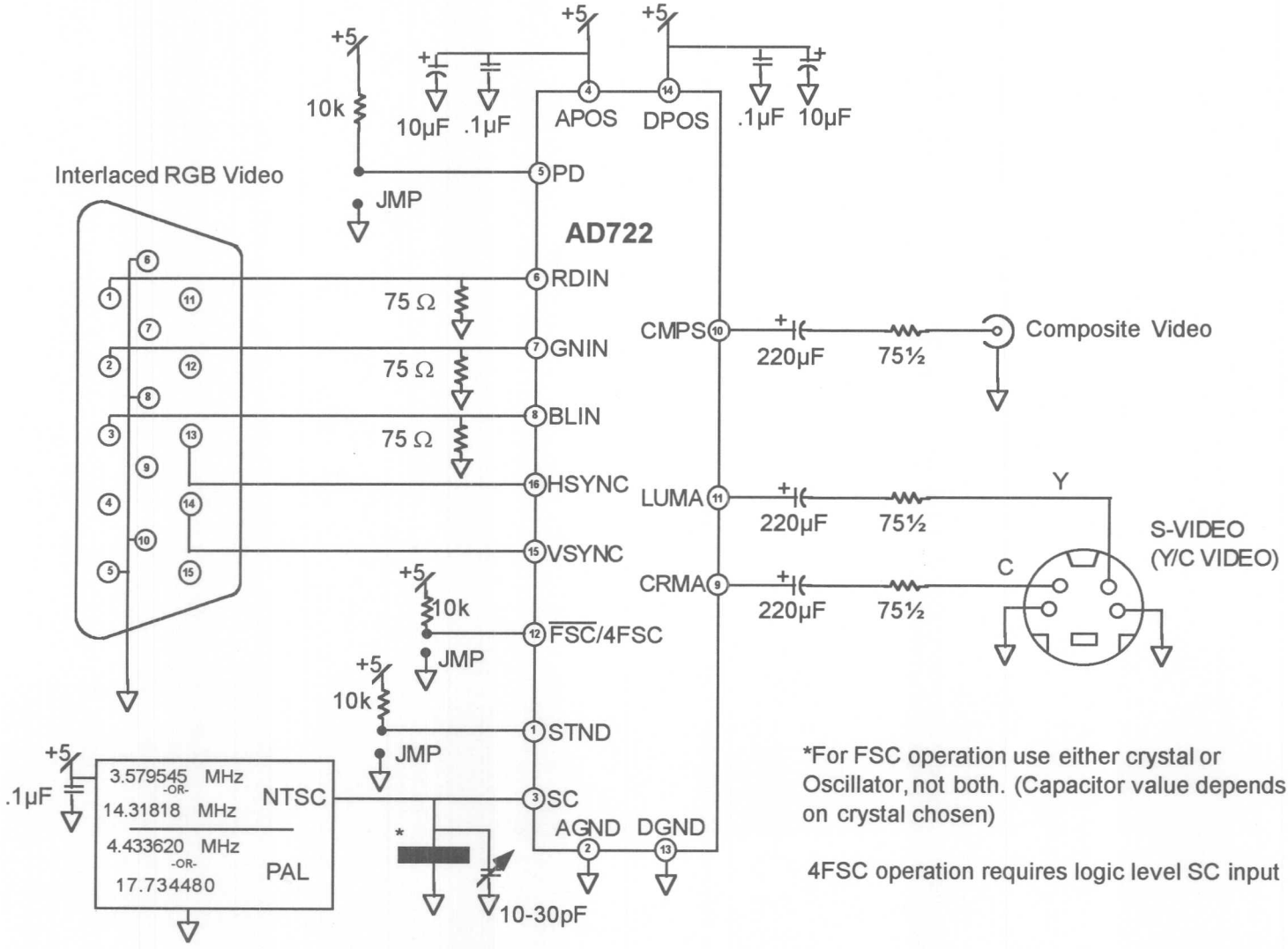
KEY SPECS AND FEATURES:

- Single +5 Volt Supply Operation Consumes Only 150 mW
- Versatile Timing Interface
  - FSC or 4FSC Clock
  - External Crystal
  - 3.58 MHz (NTSC) or 4.43 MHz (PAL)
- Accepts HSYNC and VSYNC from Standard VGA
- On-Board Phase-Locking to External Subcarrier Supports GENLOCK Applications
- 0 deg C to 70 deg C Operation

**Preliminary Technical Information*



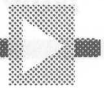
A Functional Block Diagram of the AD722



*For FSC operation use either crystal or Oscillator, not both. (Capacitor value depends on crystal chosen)

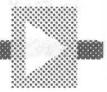
4FSC operation requires logic level SC input

Interfacing the AD722 to the (Interlaced) VGA Port of a PC



SECTION 3
ANALOG-TO-DIGITAL CONVERTERS

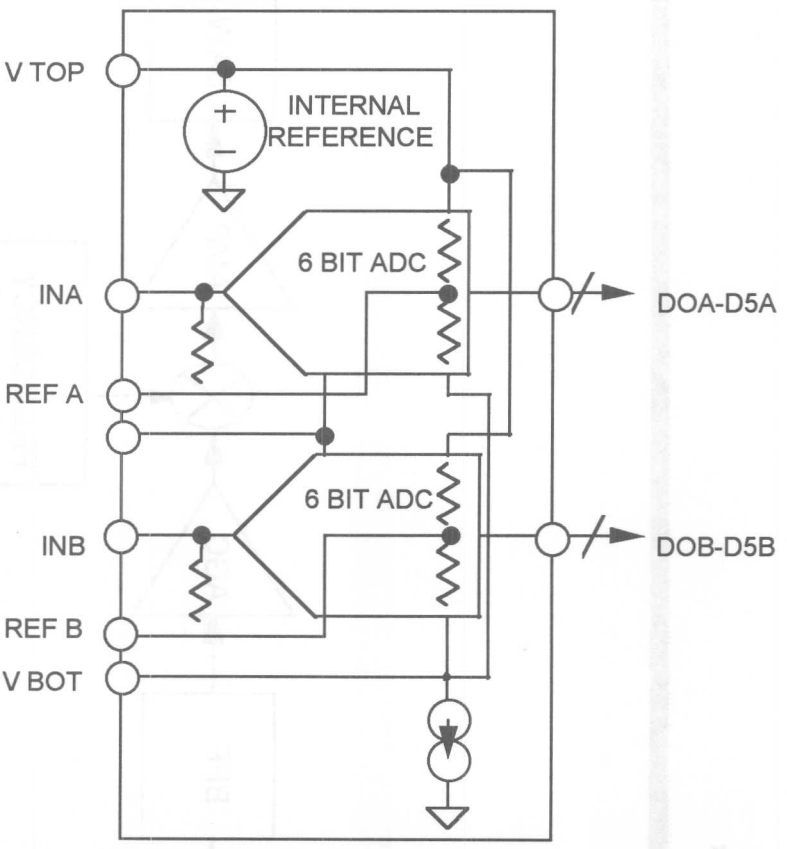
High Speed Converters
Low Power Converters
High Resolution Converters
Multi-Channel Converters



AD9066*
Dual 6-Bit, 60 MSPS, Low Power A-D Converter

The AD9066 is a low cost, monolithic, dual 6-bit ADC design-optimized for use in the base-band demodulation applications within Direct Broadcast Satellite (DBS) systems.

28 Pin SOIC

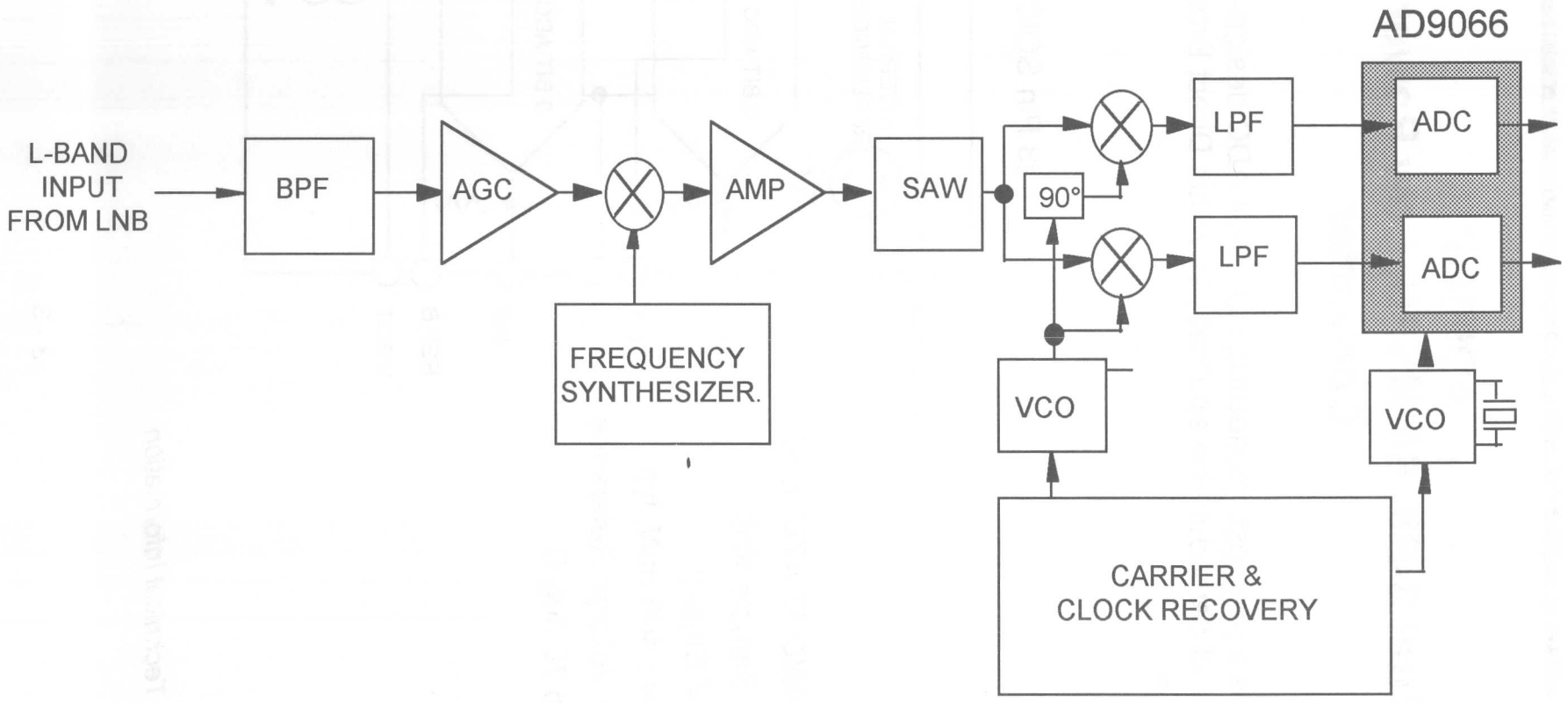


KEY SPECS AND FEATURES:

- 60 MSPS Sample Rate
- Single +5V Supply
- Low Power : 400 mW, typ
- On-Board Voltage Reference
- 0 deg C to 70 deg C Operation

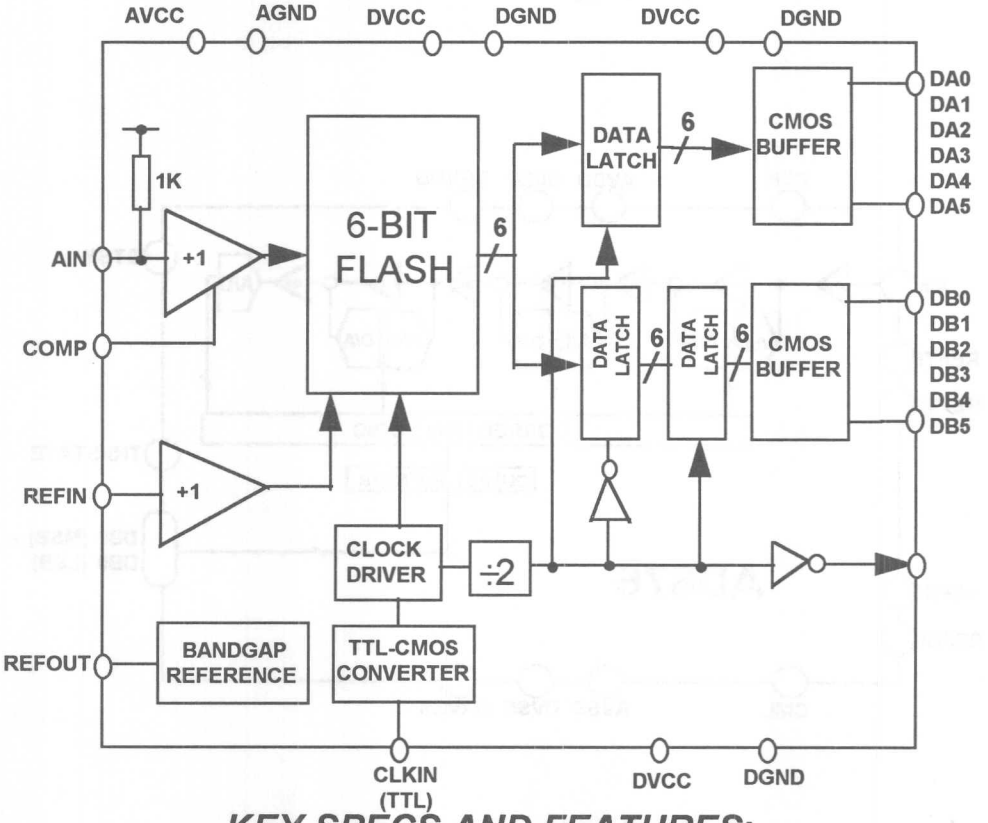
**Preliminary Technical Information*

AD9066*



The AD9066 is shown digitizing the in-phase and quadrature components in a typical base-band demodulation circuit.

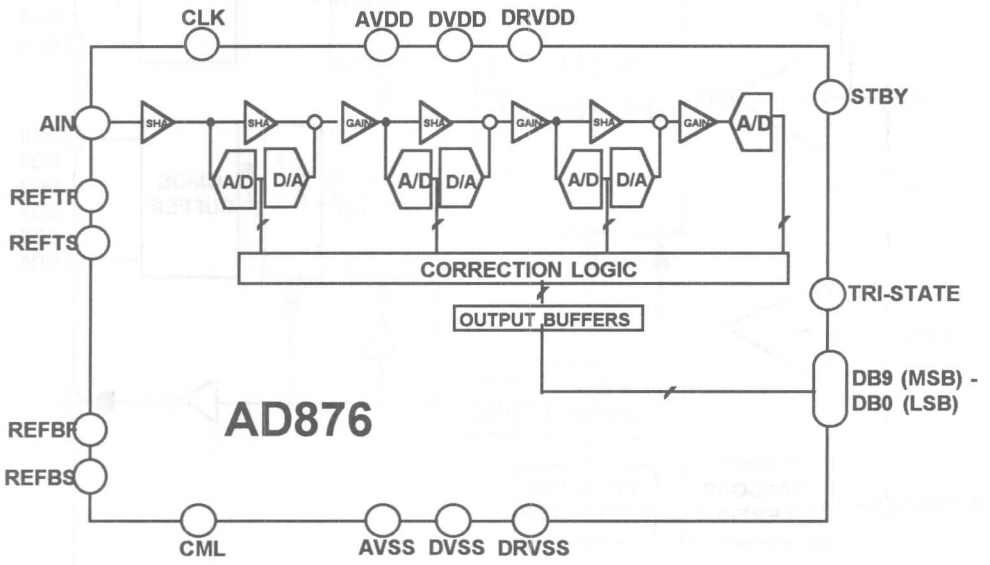
AD7620*
6-Bit, 80 MSPS, Flash A-D Converter



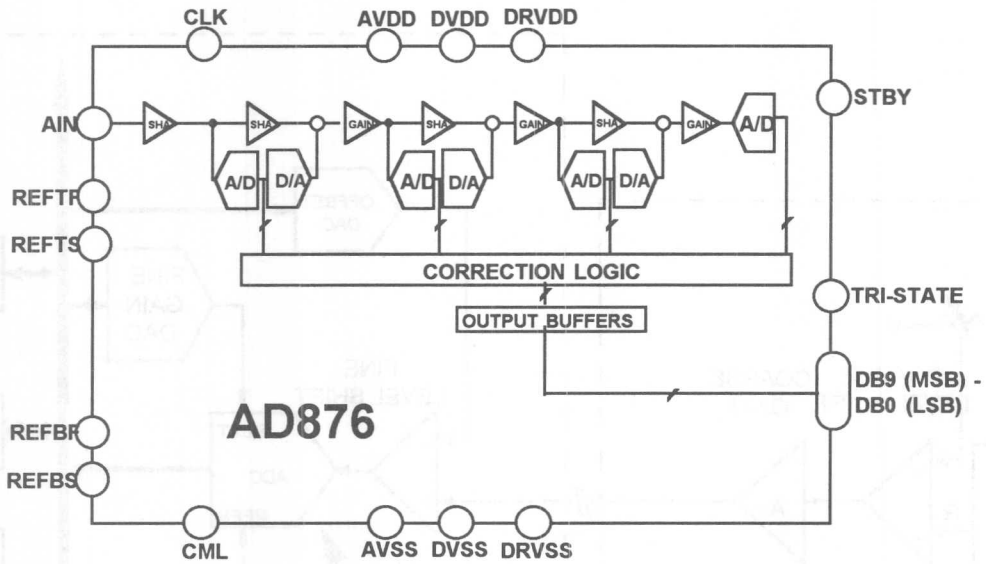
KEY SPECS AND FEATURES:

- 80 MSPS Encode Rate
- 100 MHz Input Bandwidth
- Dynamic Performance:
  - » 0.5 dB Max Gain Flatness, F_{IN} = 47.5 - 72.5 MHz
  - » 32 dB Minimum Signal-Noise Ratio
  - » 40 dB THD @ F_{IN} = 70 MHz
- TTL-Compatible Inputs and Outputs
- Internal or External 1V Reference
- Single + 5V Supply Operation:
  - » Consumes Only 450 mW
- 28-Pin SOIC Package
- Evaluation Board Available

AD876
10 Bit, 20 MSPS Low Power Sampling A-D Converter

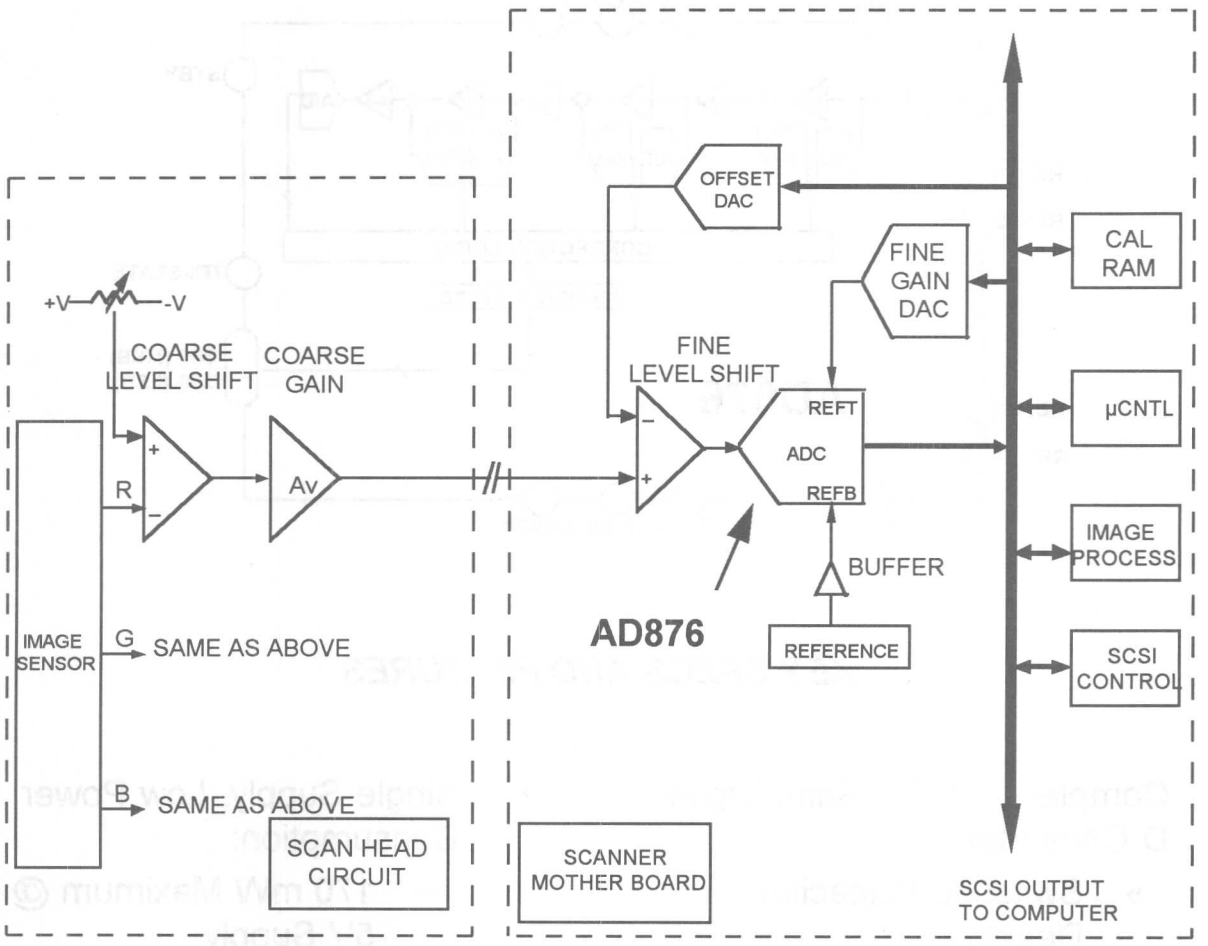


The AD876 uses a unique, multi-stage pipelined architecture plus output error correction logic to offer accurate performance with no missing codes over the full temperature range.



KEY SPECS AND FEATURES

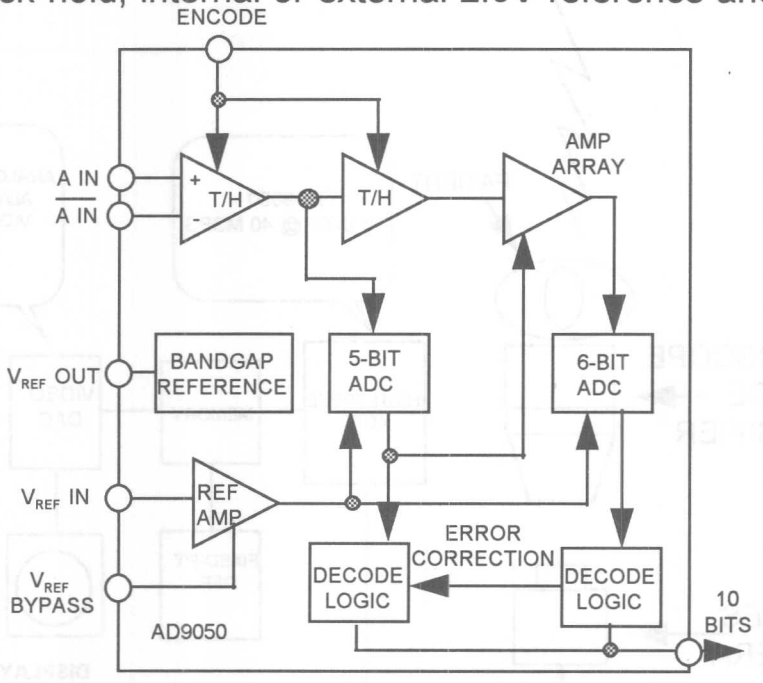
- Complete, CMOS Sampling A-D Converter:
  - » Switched Capacitor Design
  - » Built-In Sampling Function
  - » Adjustable Reference Input
  - » Three State Outputs
- Excellent DNL Performance:
  ± 1.0 LSB maximum
- Guaranteed No Missing Codes
- 2V p-p Input Range
- Single Supply, Low Power Consumption:
  - – 170 mW Maximum @ + 5V Supply
  - – < 50 mW in Power-Down (Standby) Mode
- Digital I/O Compatible with + 5V or + 3.3V logic
- Space-Saving 28-Pin SOIC or 48-Pin Thin Quad Flat Pack (TQFP)
- 0 deg C to 70 deg C Operation
- Pin-Compatible with AD875



An example of the AD876 used in a flatbed/transparency scanner

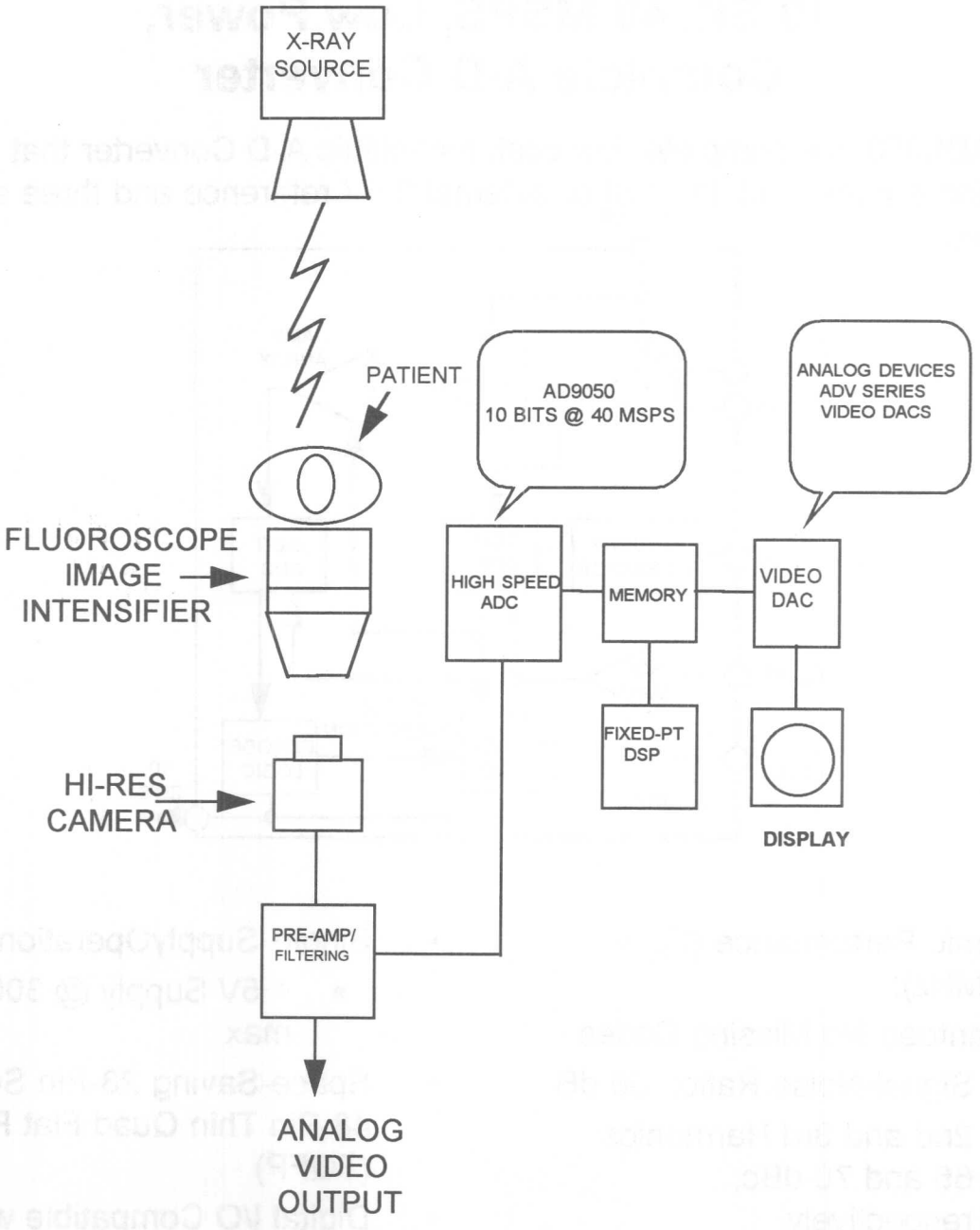
AD9050*
10 Bit, 40 MSPS, Low Power, Complete A-D Converter

The AD9050 is a complete, low cost, monolithic A-D Converter that includes a track-hold, internal or external 2.5V reference and three state outputs.



- Dynamic Performance (F_{IN} = 10.3 MHz):
- Guaranteed No Missing Codes
  - » Signal-Noise Ratio: 56 dB
  - » 2nd and 3rd Harmonics: 65 and 70 dBc, respectively
  - » Differential Gain : 0.25 %
  - » Differential Phase : 0.15 Degrees
- Single SupplyOperation
  - » + 5V Supply @ 300 mW, max
- Space-Saving 28-Pin SOIC or 48-Pin Thin Quad Flat Pack (TQFP)
- Digital I/O Compatible with + 5V or + 3.3V Logic
- 0 deg C to + 85 deg C Operation

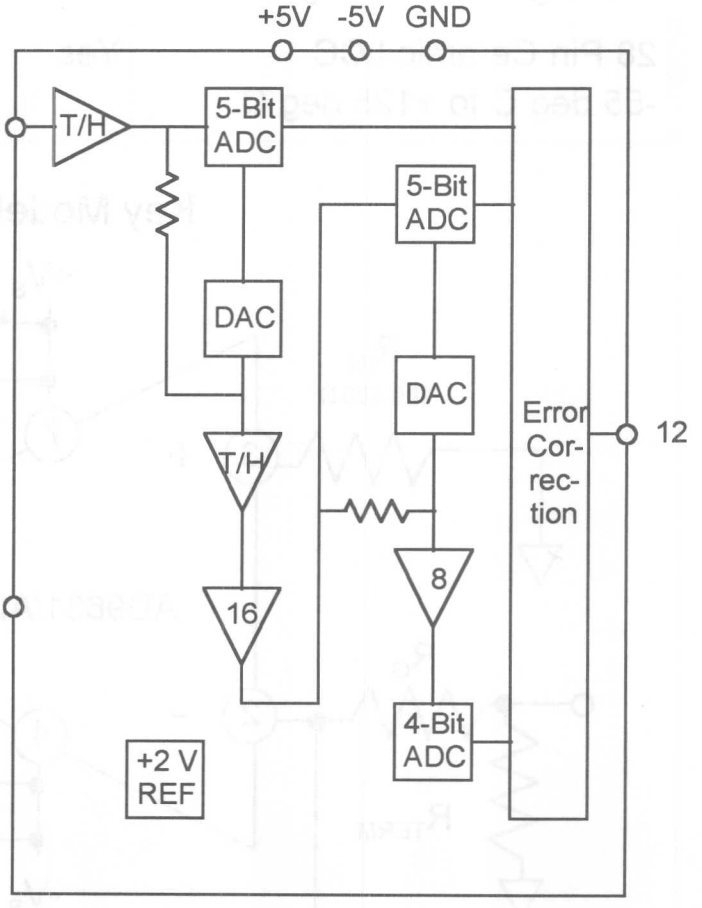
**Preliminary Technical Information*



The AD9050 is shown in a digital fluorography application

AD9022/AD9023 and AD9026/AD9027 12 Bit, High Speed TTL/ECL A-D Converters

The AD9022/AD9023 and AD9026/AD9027 are complete, monolithic A-D converters that include an on-board Track-Hold with, a precision 2.048V reference and either TTL (AD9022, AD9026) or ECL (AD9023, AD9027) compatible logic.

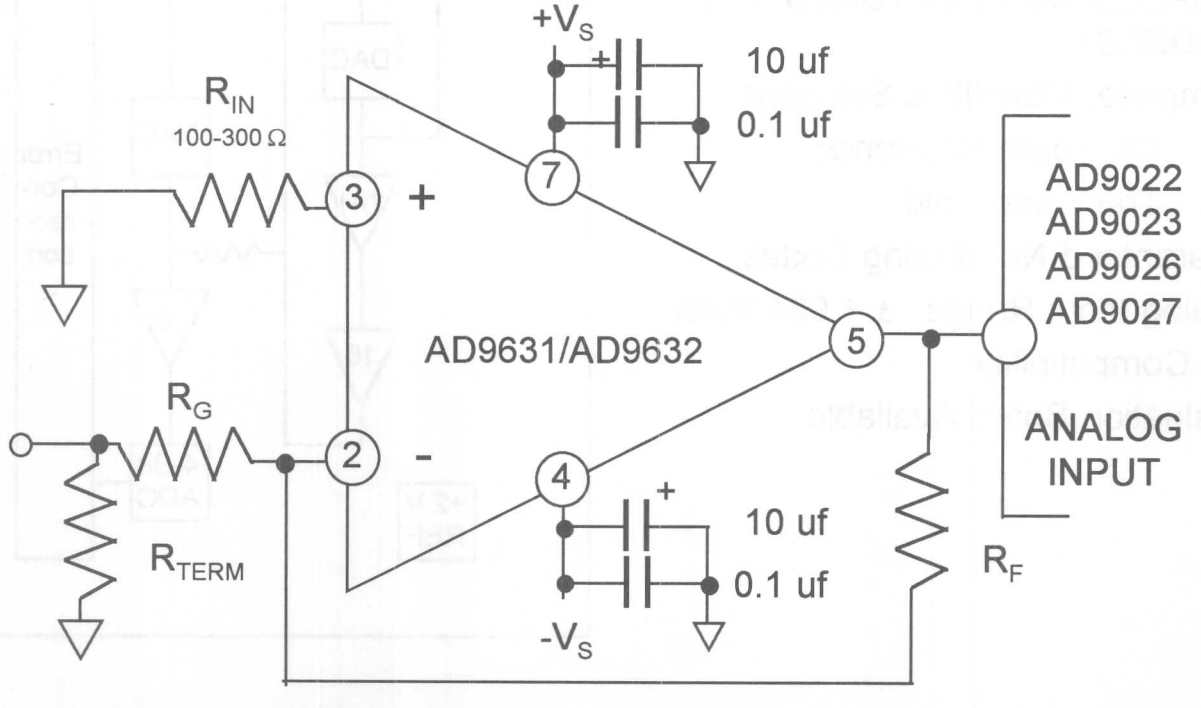


KEY SPECS AND FEATURES (ALL MODELS):

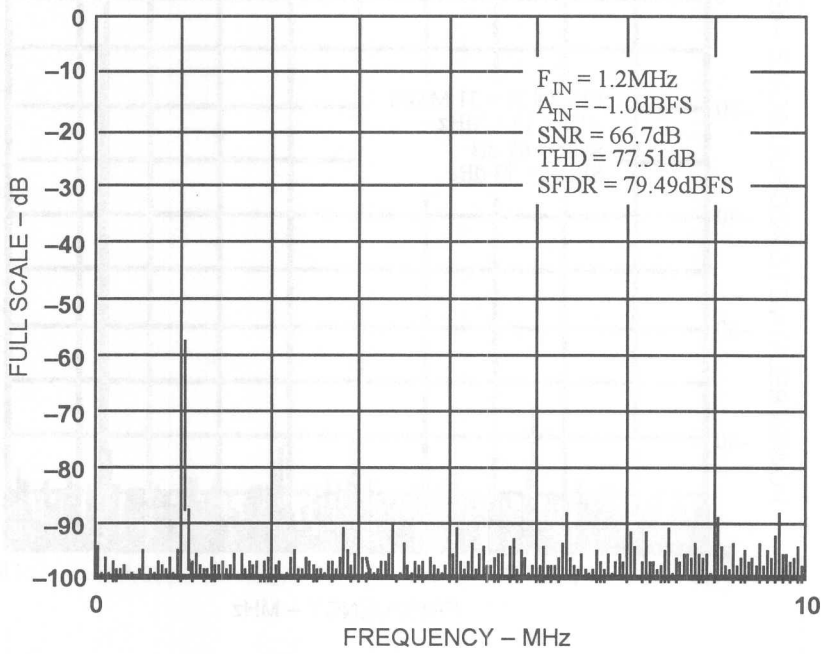
- Complete, Monolithic Solutions:
  - On Board Reference
  - Track and Hold
- Guaranteed No Missing Codes
- Analog Input Range: ± 1.024 Volts
- Pin Compatibility
- Evaluation Board Available

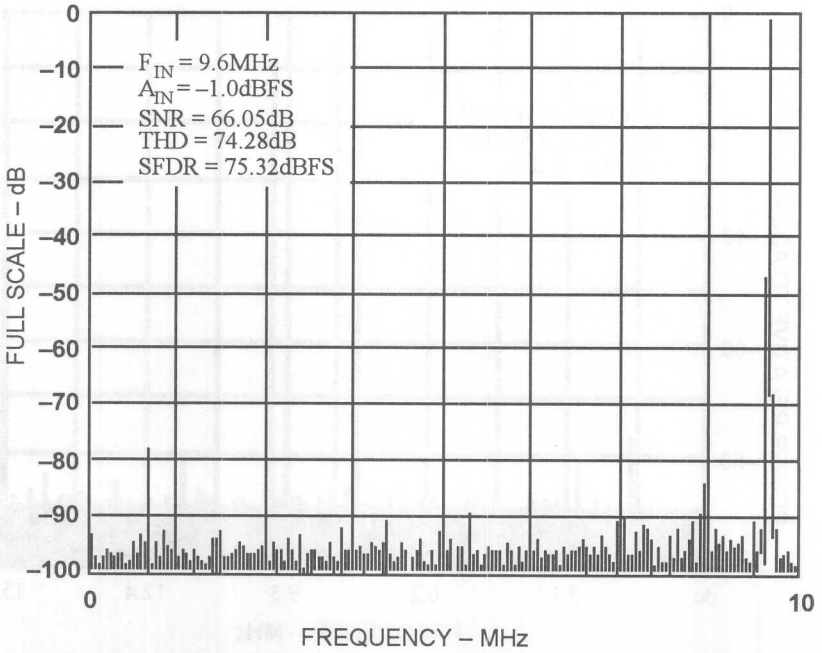
	AD9022	AD9023	AD9026	AD9027
Sampling Rate, MSPS	20	20	25.6	31
Input Bandwidth, MHz	110	110	150	150
Logic	TTL	ECL	TTL	ECL
SFDR, dBc	74	72	76	76
28 Pin Ceramic DIP -25 deg C to +85 deg C	Yes	Yes	Yes	Yes
28 Pin Ceramic LCC -55 deg C to +125 deg C	Yes	Yes	No	No

Key Model Differences

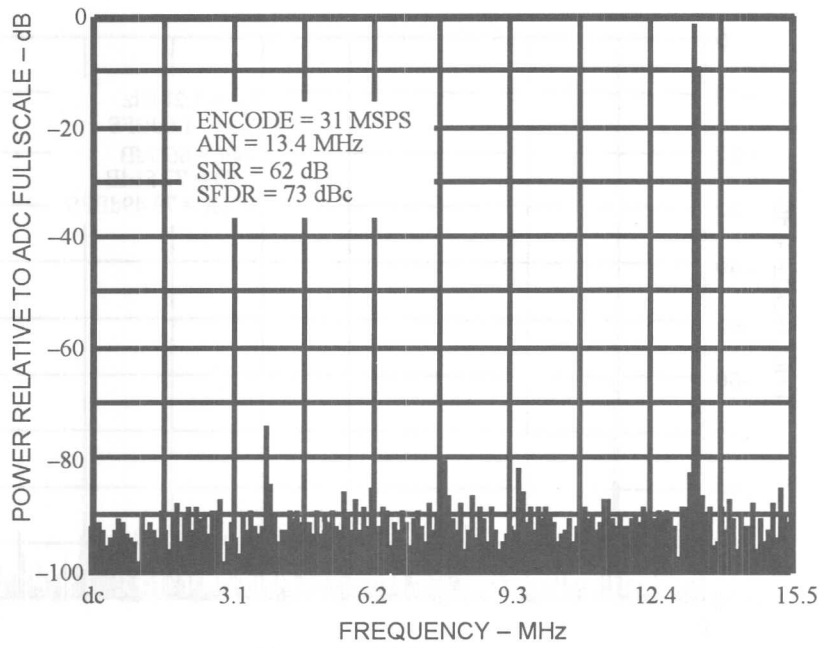


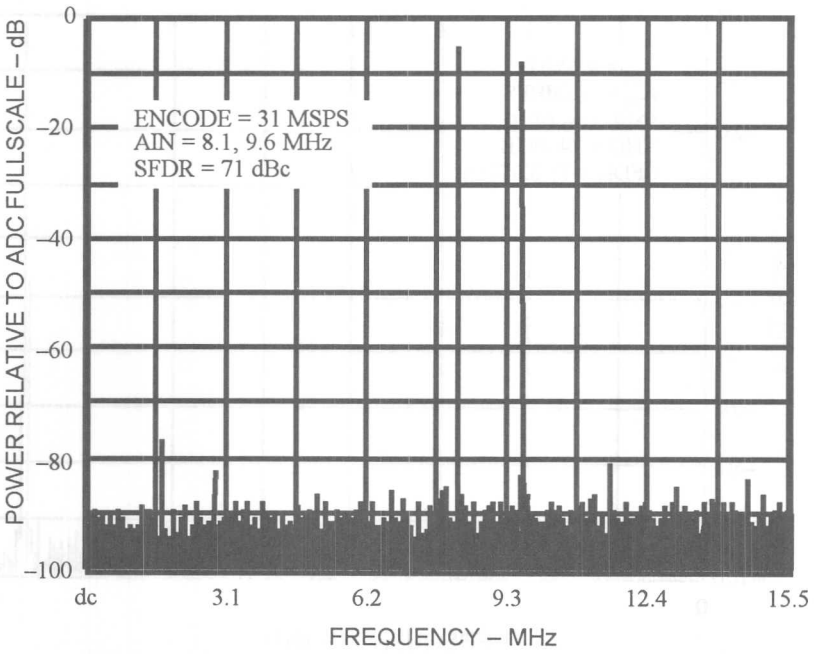
Recommended drive circuit





An FFT plot of the AD9022 at input frequencies of 1.2 MHz (top) and 9.6 MHz (bottom)

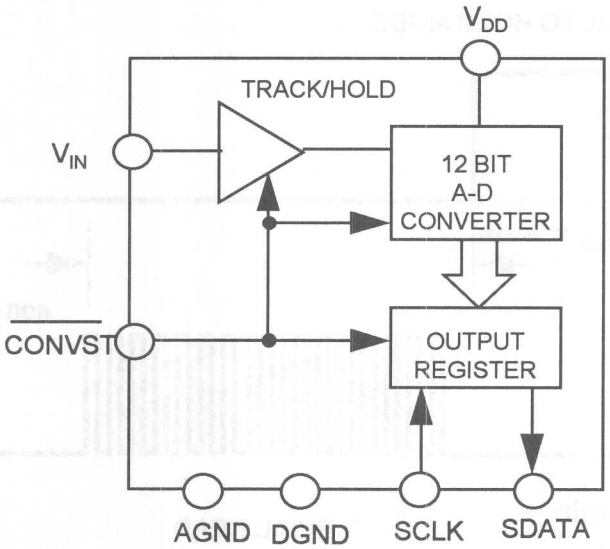




A single tone FFT plot of the AD9027 at an input frequency of 13.4 MHz (top) and a two-tone FFT at input frequencies of 8.1 and 9.6 MHz (bottom).

AD7896
12 Bit, 125 kSPS, 3V, Low Power Serial A-D Converter

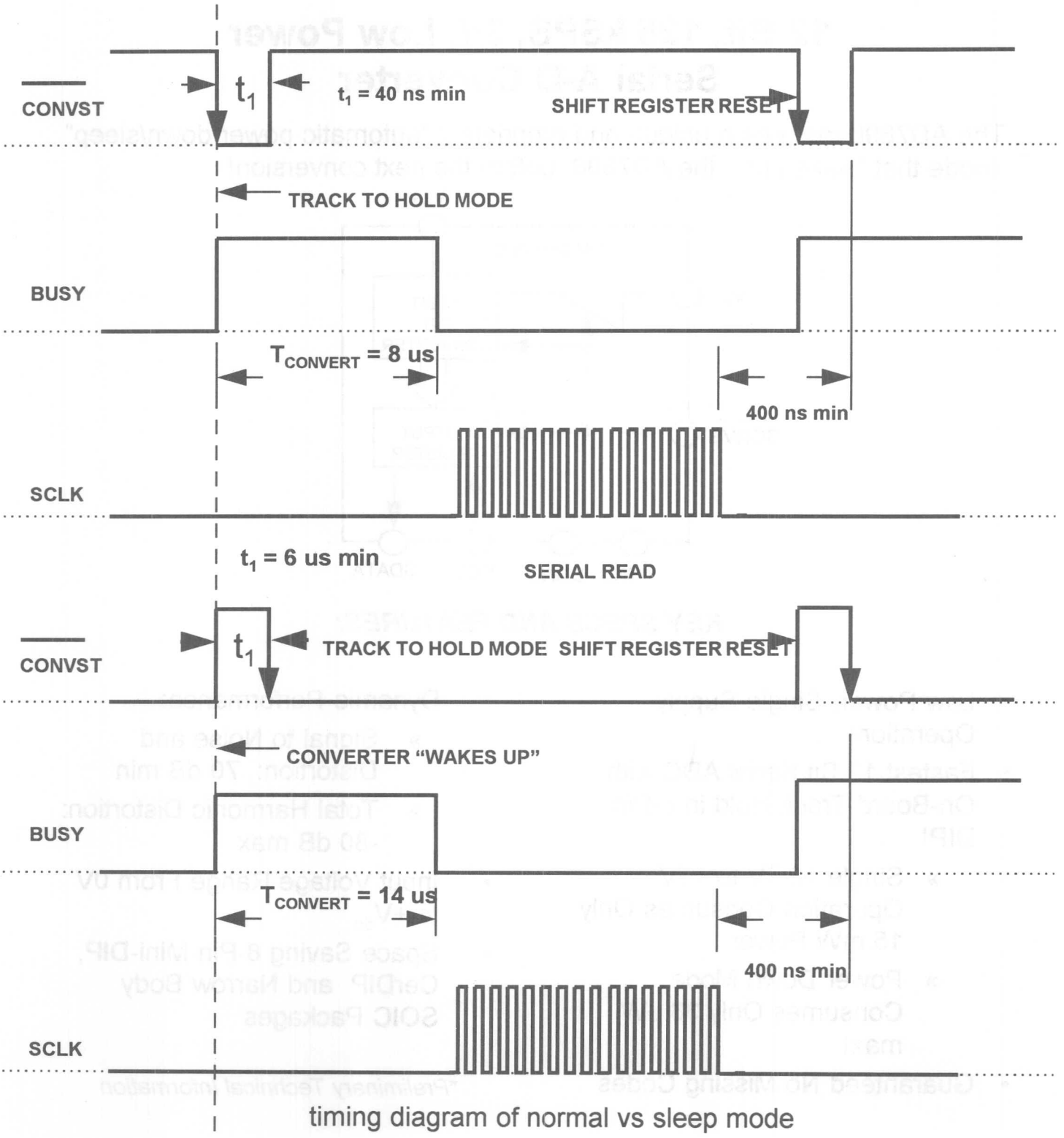
The AD7896 features a unique and proprietary "automatic power down/sleep" mode that "wakes up" the AD7896 before the next conversion!



KEY SPECS AND FEATURES:

- Low Power, Single Supply Operation:
- Fastest 12 Bit Serial ADC with On-Board Track-Hold in 8-Pin DIP!
  - » Single +2.7V to +5V Operation Consumes Only 15 mW Power
  - » Power Down Mode Consumes Only 36 uW max!
- Guaranteed No Missing Codes
- Dynamic Performance:
  - » Signal to Noise and Distortion: 70 dB min
  - » Total Harmonic Distortion: -80 dB max
- Input Voltage Range From 0V to $+V_{dd}$
- Space Saving 8-Pin Mini-DIP, CerDIP and Narrow Body SOIC Packages

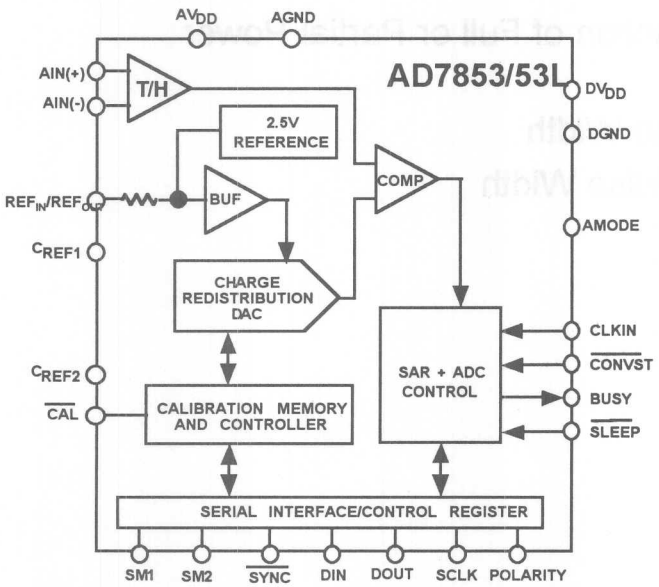
**Preliminary Technical Information*

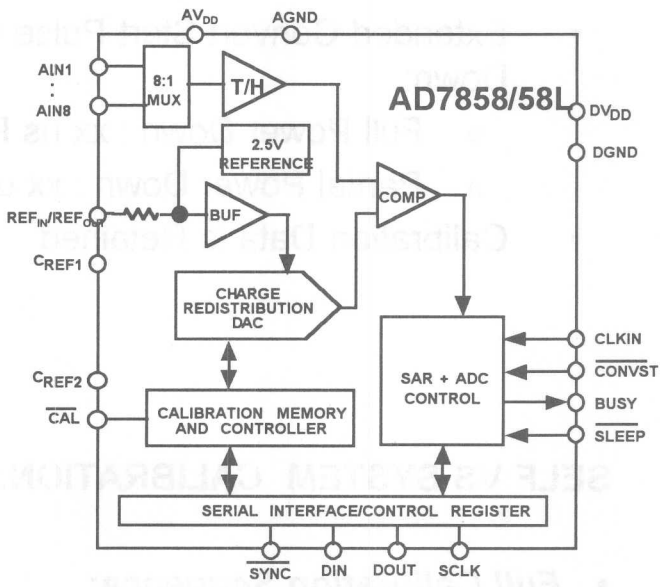


timing diagram of normal vs sleep mode

AD7853/AD7853L* and AD7858/AD7858L* 12 Bit, 200 kSPS, 3V, Low Power Serial A-D Converters

The AD7853/53L (single channel) and AD7858/58L (multi-channel) are *low cost, low power* 12 bit, serial ADC's that feature on-chip self and system calibration, plus power down/sleep mode!





- Fast, 12 Bit ADC with T/H and Reference:
  - » AD7853, AD7858: 200 ksps
  - » AD7853L, AD7858L : 100 ksps
- Self or System Calibration of Gain and Offset
- Read/Write Calibration Coefficients
- Full or Partial Power Down (Sleep) Mode
- Fully Specified @ +3V to +5V Operation
- Analog Input Range :
  - » 0 to V_{DD}
  - » 0 to $\pm V_{DD}/2$ (AD7853/53L, only)
- Low Power Consumption
  - » < 55 uW Sleep Mode
  - » < 30 mW Normal Mode
- Flexible Serial Interface
  - » Three-wire SPI Compatible
  - » Two-wire 8051 Compatible
- -40 deg C to +85 deg C Operation
- 24 Pin DIP, SOIC and SSOP Packages

**Preliminary Terchnical Information*

POWER DOWN ($\overline{\text{SLEEP}}$) MODE OF OPERATION:

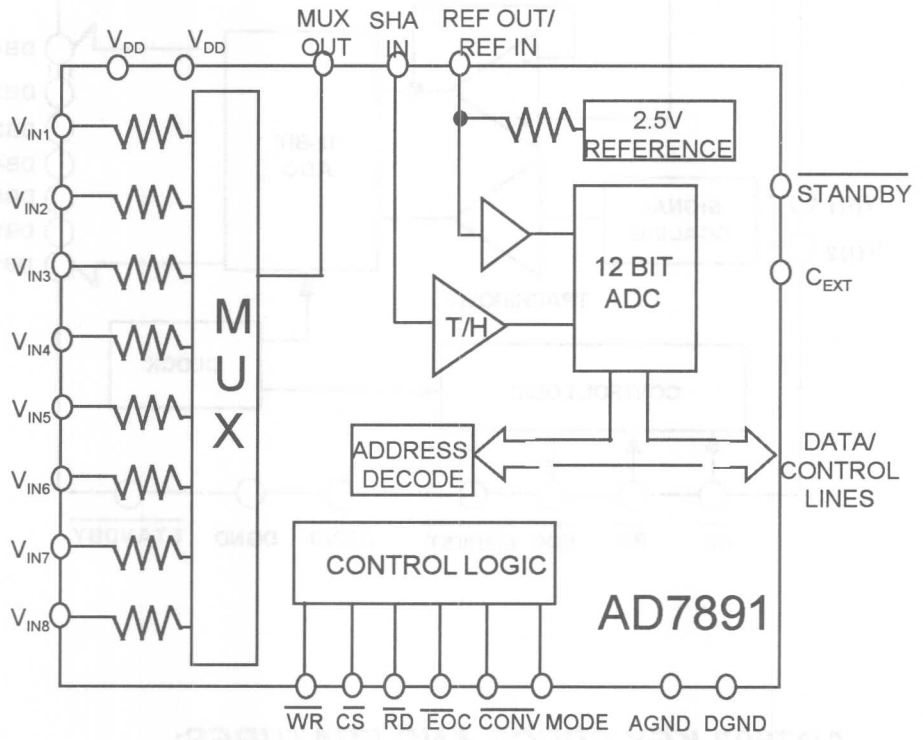
- Connect $\overline{\text{SLEEP}}$ pin to Logic "0"
- BUSY Pin tied to $\overline{\text{SLEEP}}$ Pin - Converter Goes Into Power Down Mode at End of Conversion
- Converter "Wake Up" Time Required Before Start of Conversion
- Extended Convert Start Pulse Function of Full or Partial Power Down:
  - » Full Power Down : xx us Pulse Width
  - » Partial Power Down : xx us Pulse Width
- Calibration Data is Retained

SELF VS SYSTEM CALIBRATION:

- ***Full Calibration Sequence:***
  - » Self Calibration Calibrates Internal DAC, A/D Offset and A/D Gain
  - » System Calibration Calibrates Internal DAC, System Offset and System Gain

- ***Partial Calibration Sequence:***
  - » System Offset, Only
  - » Internal Gain, Only
  - » Internal Offset, Only
  - » System Gain, Only AD7892 to DSP56000 Serial Interface

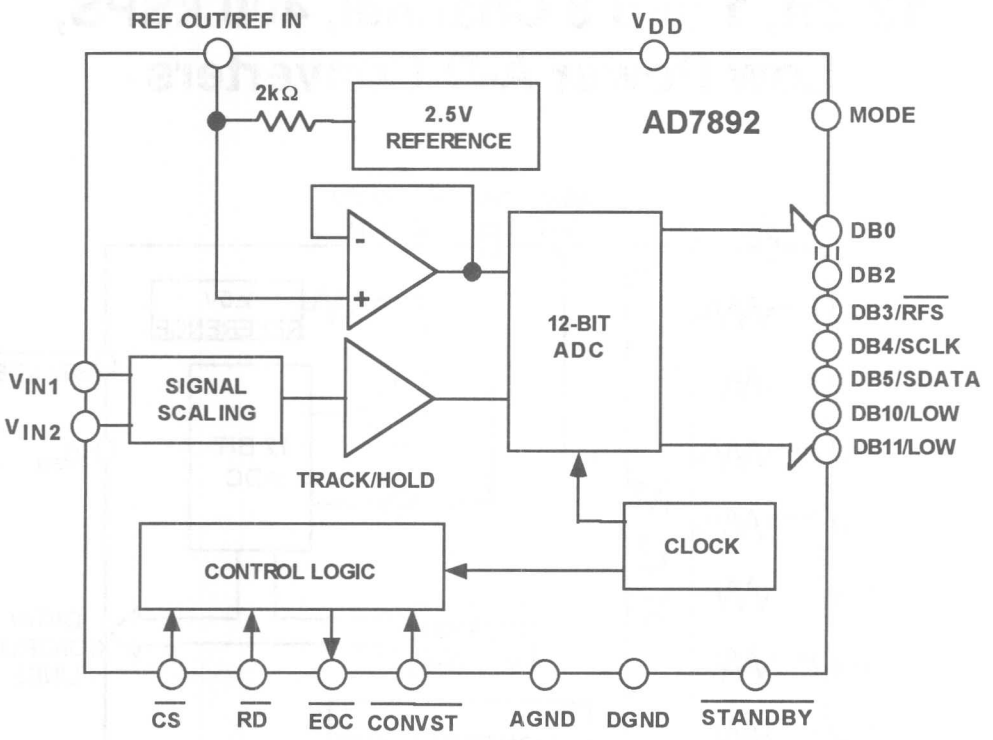
AD7891* and AD7892
12 Bit, 1 and 8 Channel, 400 kSPS, Low Power A-D Converters



AD7891 KEY SPECS AND FEATURES

- Complete 12 Bit, 8-Channel System:
  - Fast 12 Bit ADC with 1.6 µs Conversion Time
  - On-Board Track-Hold and Reference
- 8 Single-Ended Analog Input Channels
- Selection of Input Ranges:
  - AD7891-1 : ±5V, ±10V
  - AD7891-2 : +2.5V, +5V, ± 2.5V
- Separate Access to MUX and ADC

**Preliminary Technical Information*



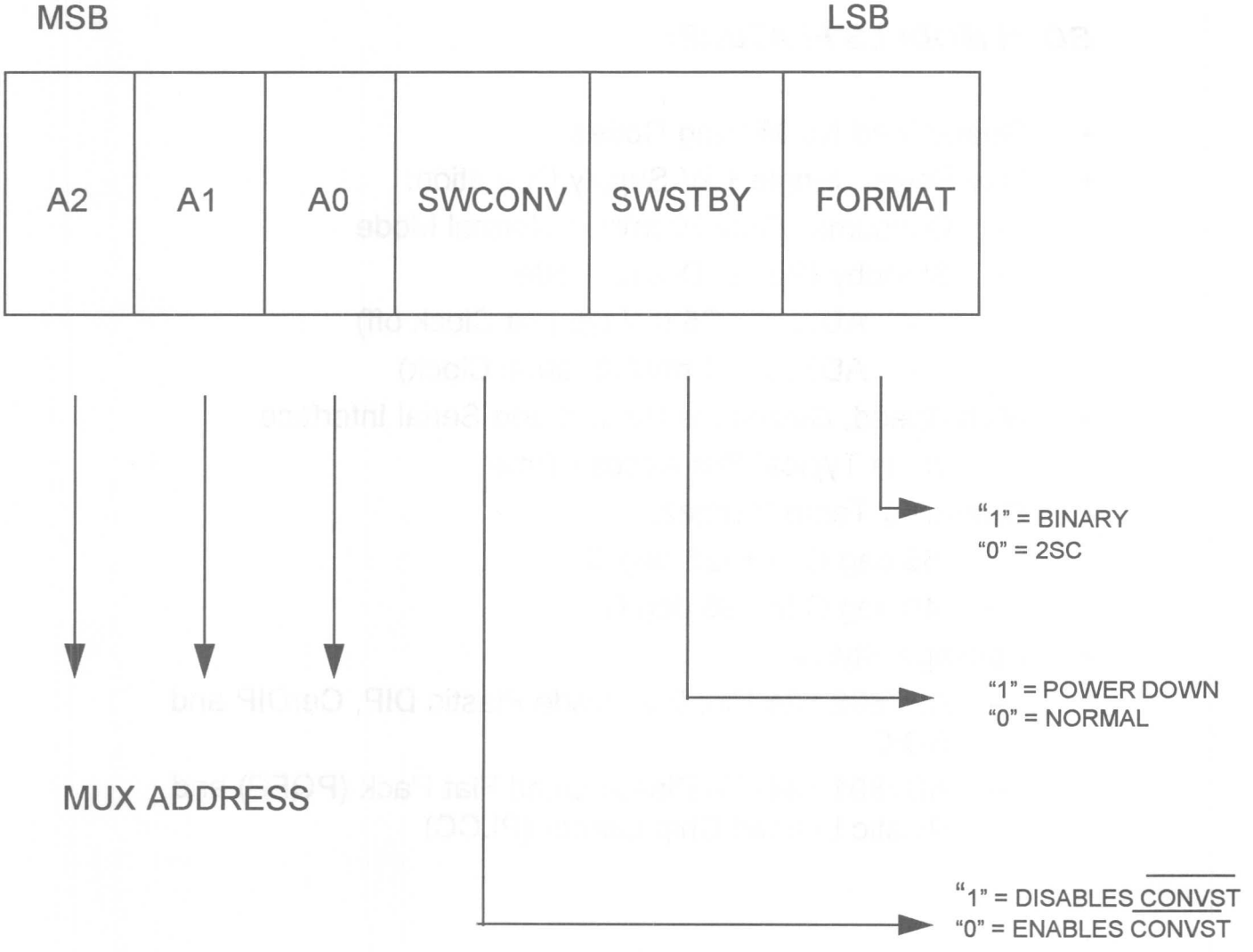
AD7892 KEY SPECS AND FEATURES:

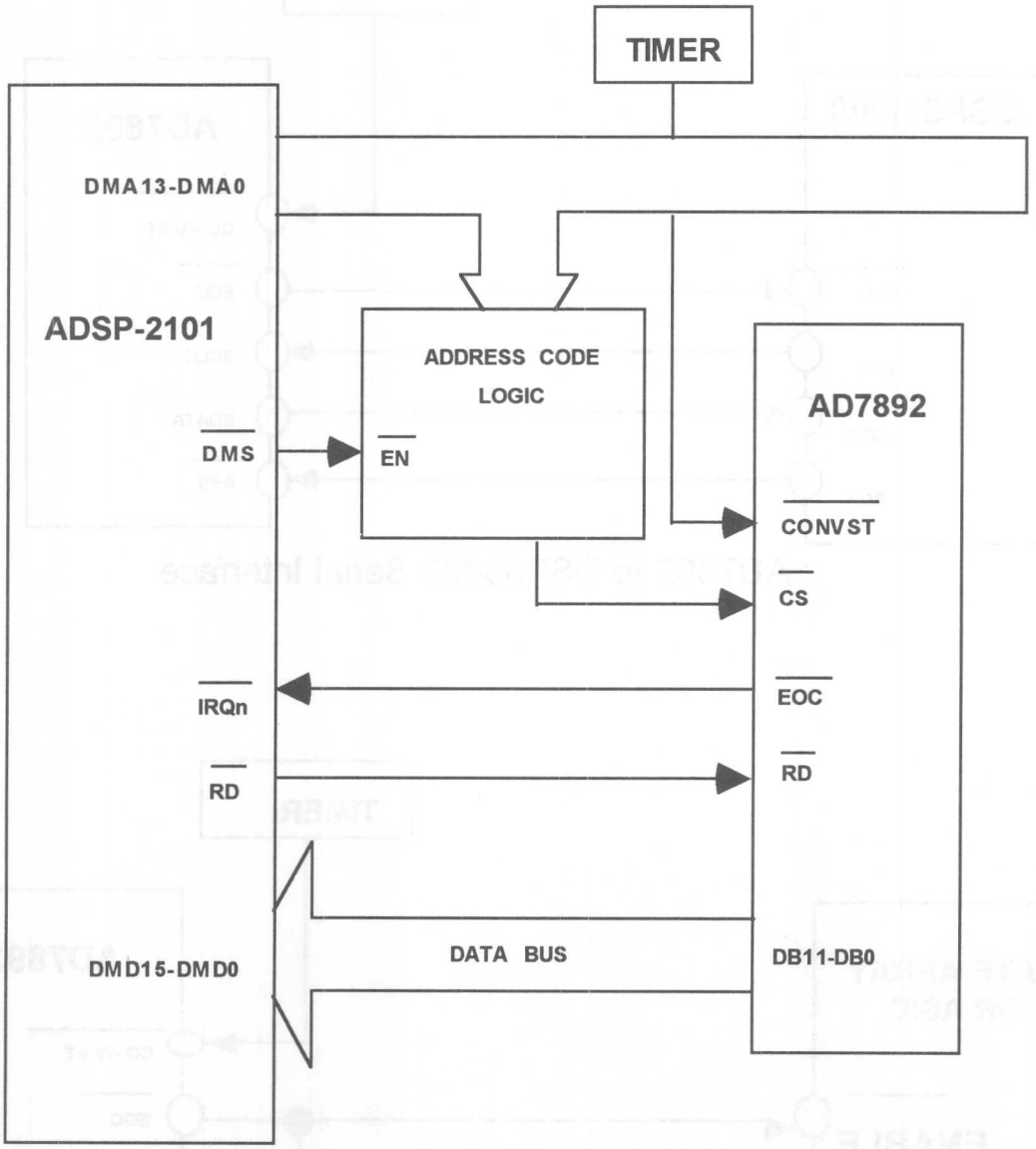
- Complete 12 Bit System
  - High Speed ADC with 1.3 us Conversion Time
  - On Board Track-Hold, Reference and Clock
- Selection of Input Range:
  - AD7892-1: ± 5V or ± 10V
  - AD7892-2 : 0V to +2.5V
  - AD7892-3 : ± 2.5V
- Throughput Rates:
  - 500 kSPS : AD7892-1, AD7892-2
  - 600 kSPS : AD7892-3

BOTH MODELS FEATURE:

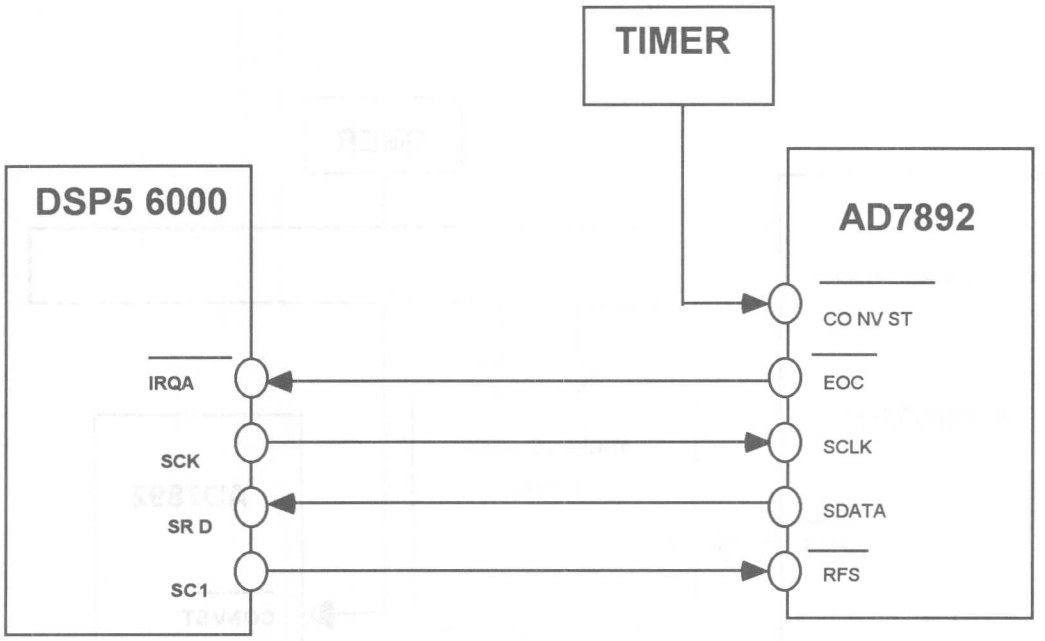
- Guaranteed No Missing Codes
- Low Power, Single +5V Supply Operation:
  - Consumes Only 60 mW in Normal Mode
  - Standby (Power Down) Mode
    - AD7891 : 75 uW typ (ext Clock off)
    - AD7892 : 1 mW (Internal Clock)
- High Speed, Selectable Parallel and Serial Interface
  - 35 ns Typical Bus Access Time
- Operating Temp Ranges:
  - -55 deg C to +125 deg C
  - -40 deg C to +85 deg C
- Package Styles
  - AD7892 : 24-Pin, 0.3" Wide Plastic DIP, CerDIP and SOIC
  - AD7891 : 44-Pin Plastic Quad Flat Pack (PQFP) and Plastic Leaded Chip Carrier (PLCC)

CONTROL REGISTER FUNCTIONS (6 BIT WORD):

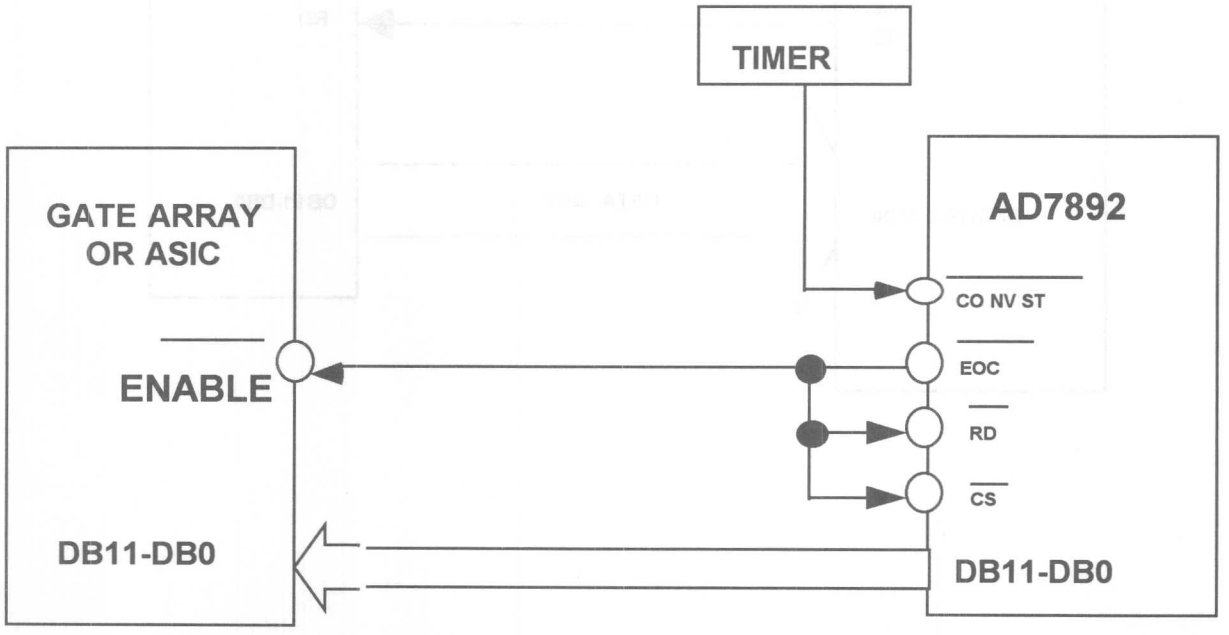




AD7892 to ADSP-2101 Parallel Interface



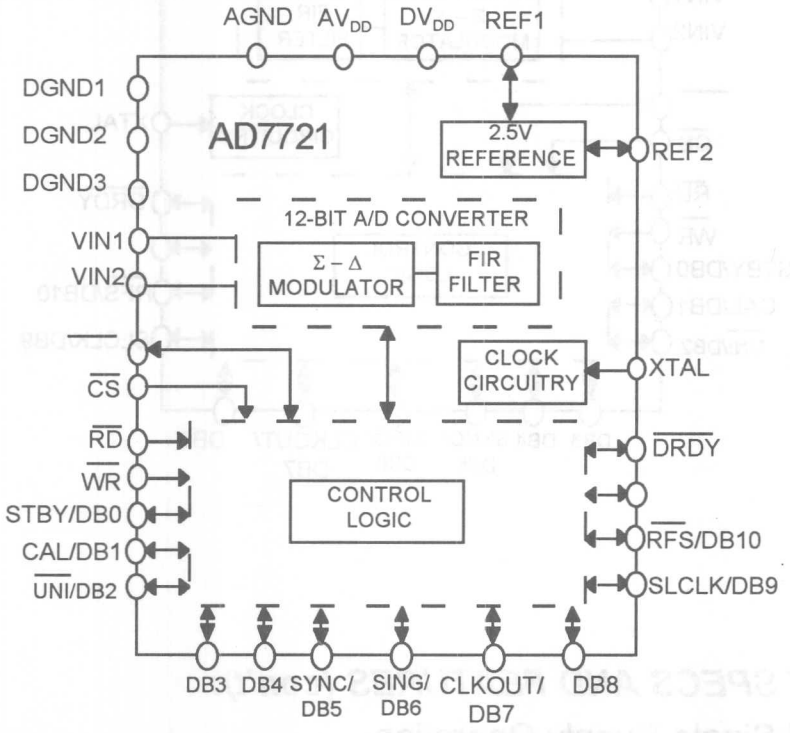
AD7892 to DSP56000 Serial Interface



AD7892 to Gate Array/ASIC Interface

AD7721*
12-Bit, 468 KSPS, 5V, Low Power Σ - Δ A-D Converters

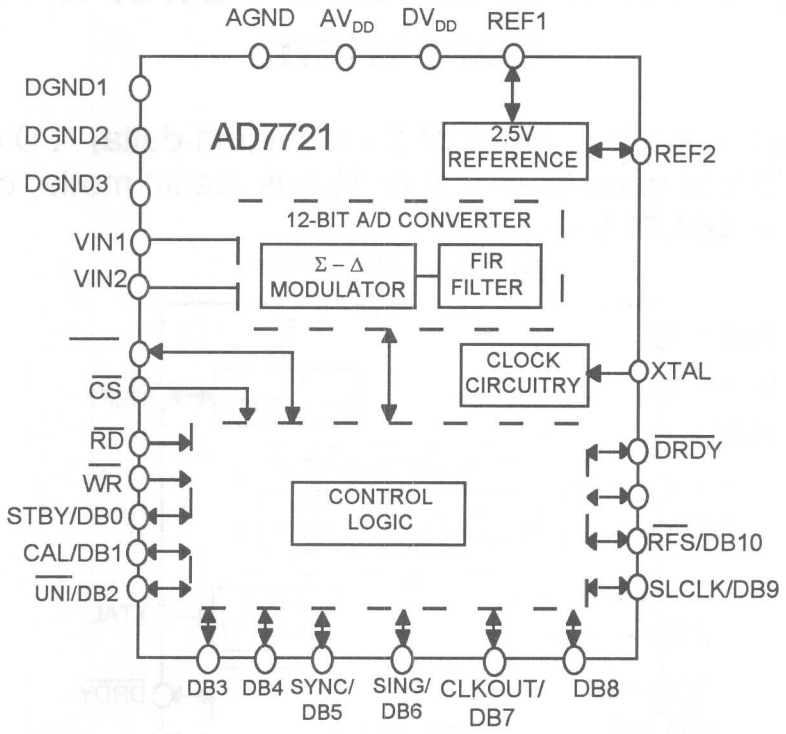
The AD7721 is a complete, low cost Σ - Δ (sigma-delta) A-D converter that provides 12 bits (parallel mode) or 16 bits (serial mode) of data at word rates up to 468.75 kHz.



KEY SPECS AND FEATURES:

- Guaranteed No Missing Codes
- Signal Input Range: 0 to V_{ref} or ± $V_{ref}/2$
- On-Chip 2.5V Reference
- 210 kHz Input Bandwidth
- 72 dB Minimum Dynamic Range
- Signal to THD & Noise: 70 dB min
- Total Harmonic Distortion: -80 dB max
- ± 0.05 dB Max Flatness, DC - 210 kHz

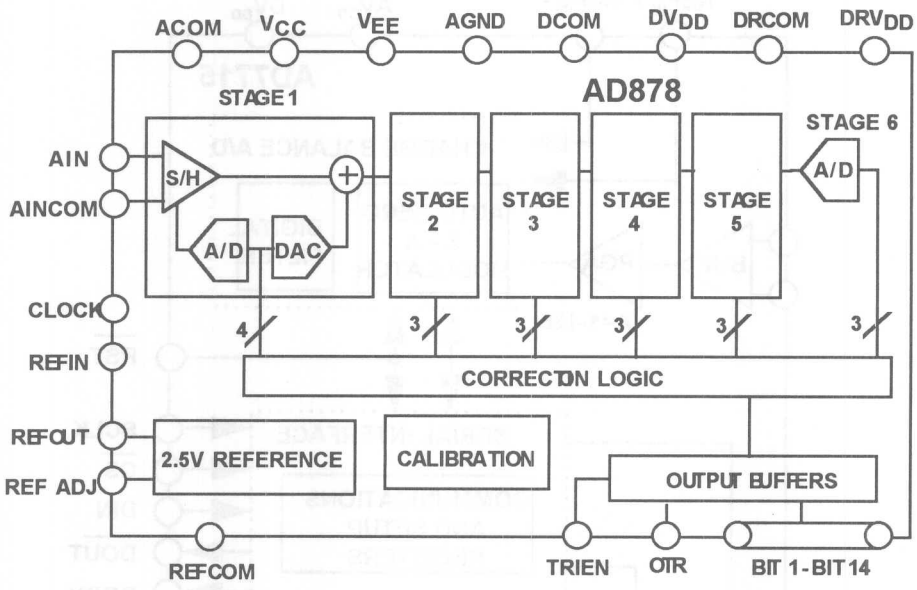
28 pin plastic DIP, CerDIP
and SOIC Packages



- ***KEY SPECS AND FEATURES (con't):***
- + 5V Single Supply Operation
  - 350 mW max, normal mode
  - 100 uW max, STANDBY mode
- Operating Temperature Range:
  - -40 deg C to +85 deg C
  - -55 deg C to +125 deg C
- 28 pin plastic DIP, CerDIP and SOIC Packages

AD878*
14-Bit, 2.2 MSPS, Low Power, Complete A-D Converter

The AD878 uses a unique, multi-stage pipelined architecture plus output error correction logic to offer accurate performance with no missing codes, while consuming only 550 mW..



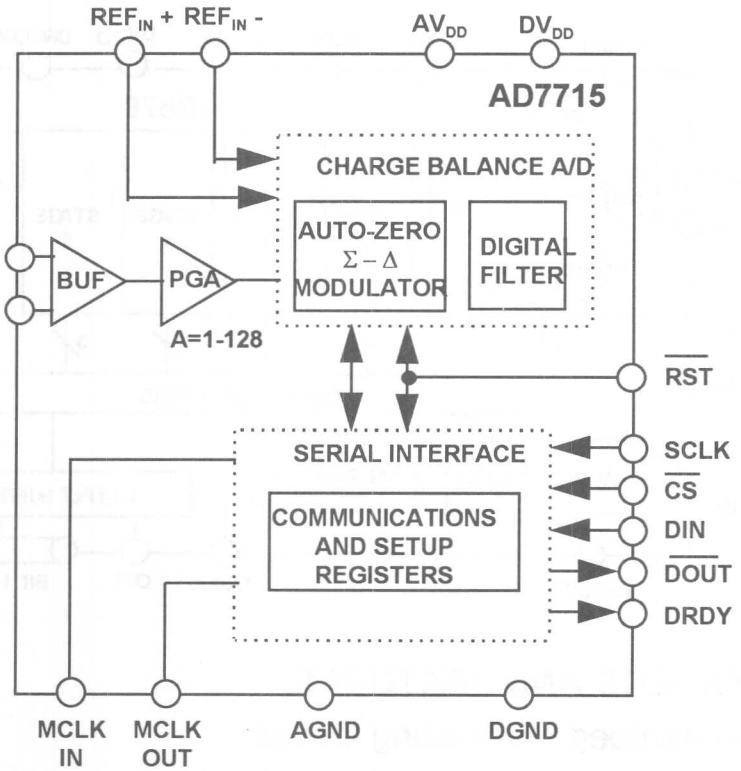
KEY SPECS AND FEATURES:

- Guaranteed No Missing Codes
- Dynamic Performance (F_{IN} = 100 kHz):
  - Signal-to-Noise & Distortion Ratio: 80 dB
  - Total Harmonic Distortion: 80 dB
  - Intermodulation Distortion: 80 dB
  - Spurious Free Dynamic Range: 85 dB
- Small Signal Bandwidth: 5 MHz
- Out Of Range (OTR) Indicator
- Low Power Operation: ± 5V @ 500 mW
- 44 Pin PLCC Package

**Preliminary Technical Information*

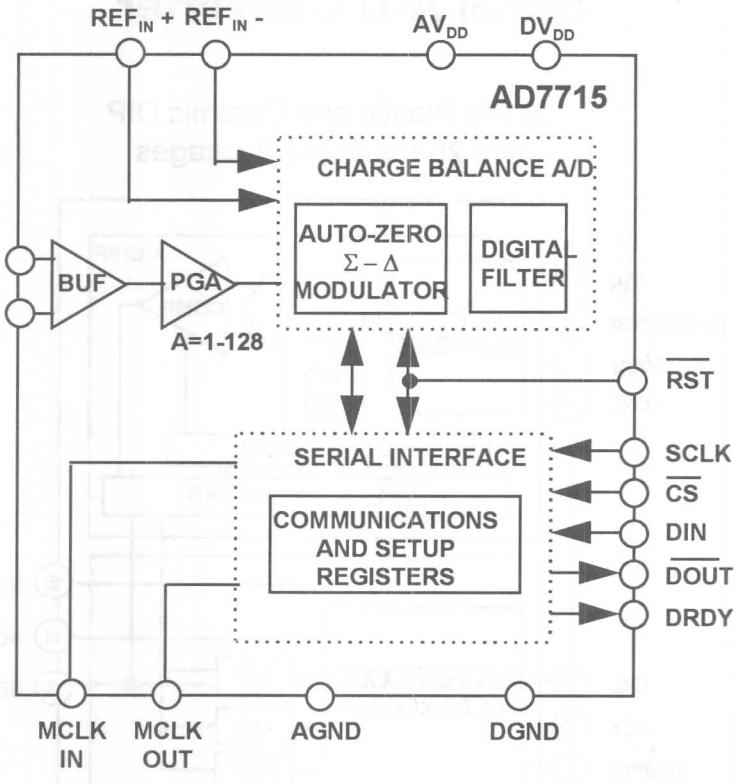
AD7715*
16 Bit, Low Cost, Low Power, $\Sigma - \Delta$ A-D Converter

The AD7715 is a complete, low cost analog front end designed for direct interfacing to low level, transducer outputs.



KEY SPECS AND FEATURES:

- 16 Bits No Missing Codes
- Programmable Gain Front End
  - 1, 2, 32 and 128
- High Impedance Differential Input
- On Chip Registers for Software Control of Output Data Rate, Input Gain, Signal Polarity and Calibration Modes
- Self and System Calibration Modes

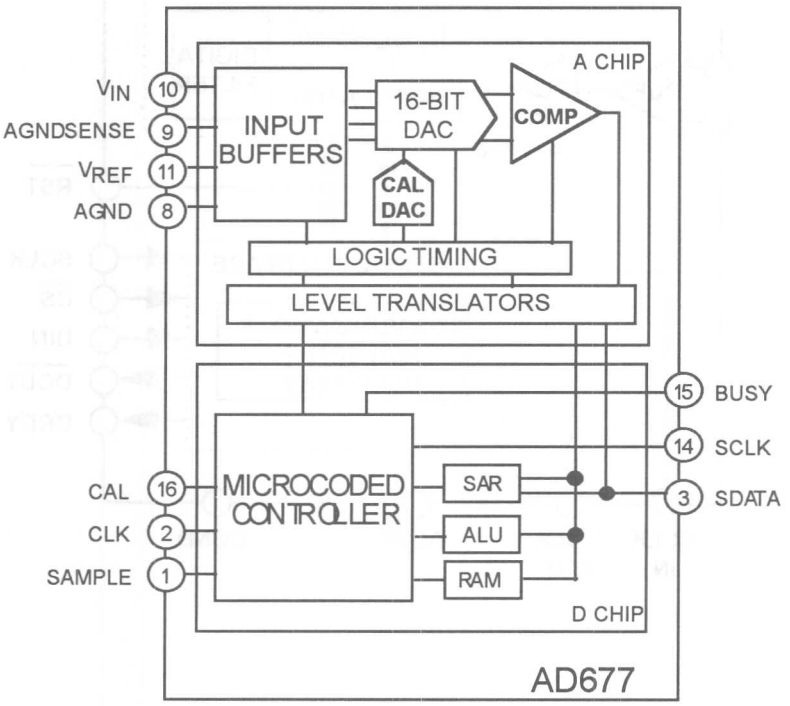


KEY SPECS AND FEATURES (CON'T):

- Programmable Digital Filter Cutoff Settings
  - 13.1 Hz to 131 Hz - 3dB Frequency
  - 50-500 Hz Output Data Rates @ MCLK = 2.4576 MHz
- Three Wire Serial Interface
- 3V or 5V Single Supply Operation
  - 500 uA max @ +3V
- 16 Pin Plastic DIP and SOIC

AD677
16-Bit, 100KSPS, Auto-Calibrating, Serial A-D Converter

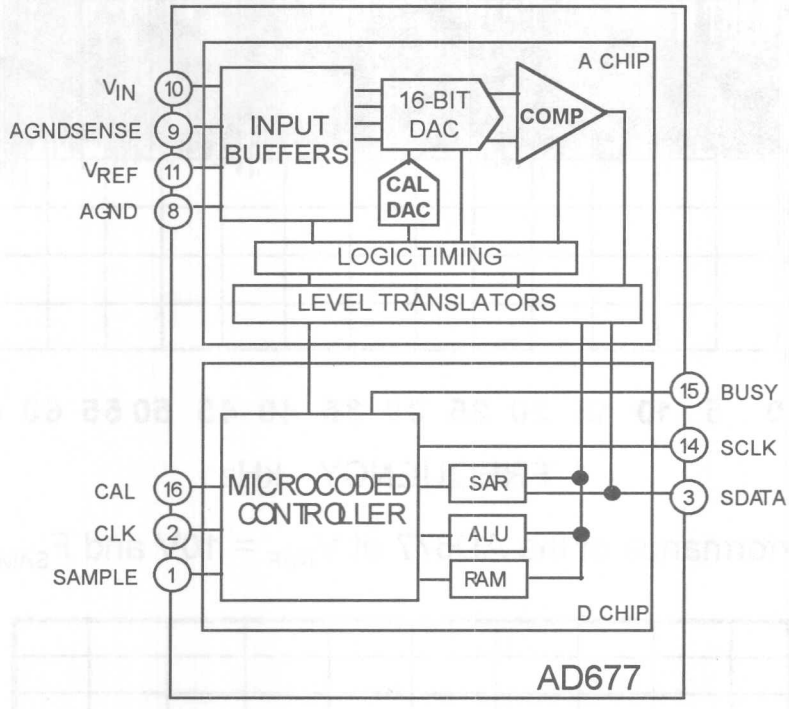
16 Pin Plastic and Ceramic DIP
and 28 Pin SOIC Packages



KEY SPECS AND FEATURES:

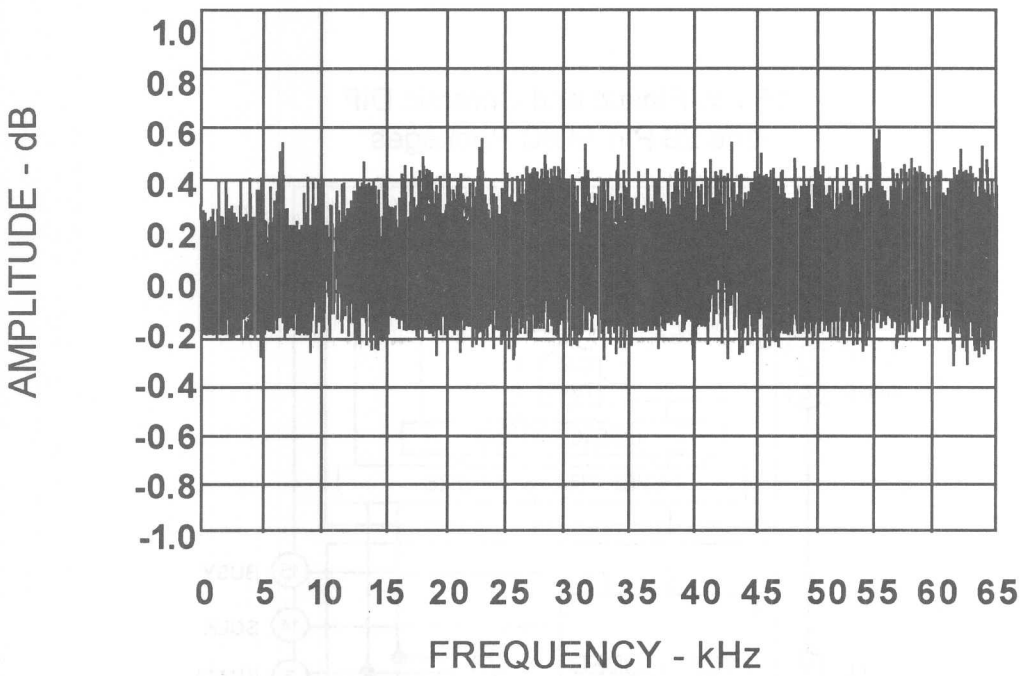
- Auto-Calibration Insures Highest Accuracy
  - ± 1 LSB max Full Scale and Zero Errors
  - Guaranteed No Missing Codes
- Dynamic Performance:
  - Signal-Noise & Distortion : 92 dB, min
  - Total Harmonic Distortion : 97 dB, typ
  - Input-Referred Noise : 160 uV RMS
  - 1 MHz Full Power Bandwidth

16 Pin Plastic and Ceramic DIP
and 28 Pin SOIC Packages

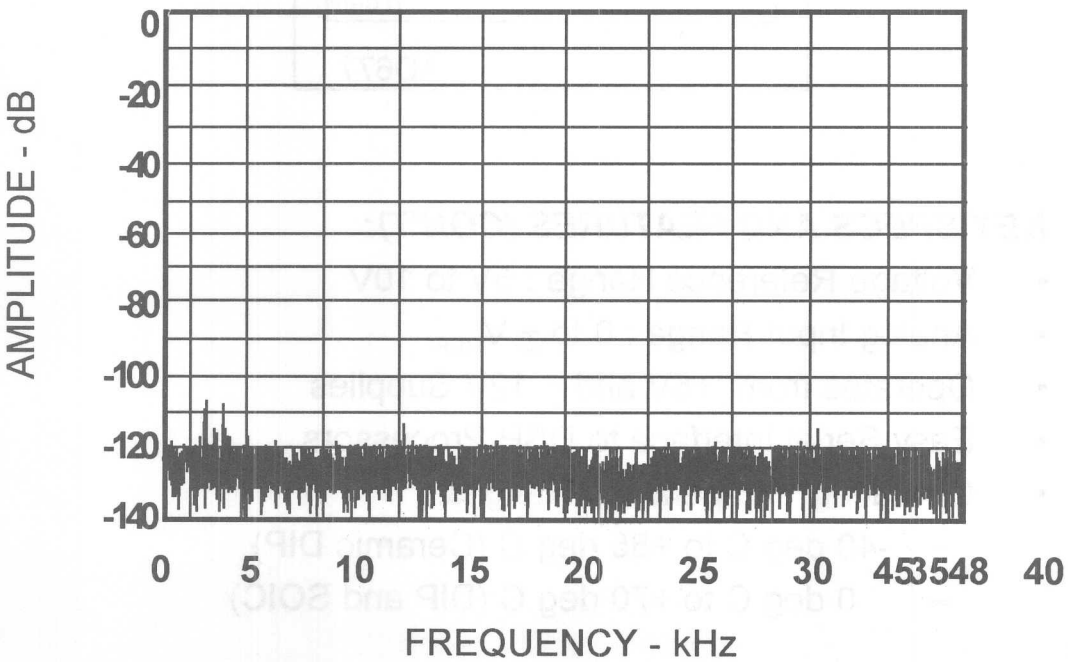


KEY SPECS AND FEATURES (CON'T):

- Voltage Reference Range : 5V to 10V
- Analog Input Range : 0 to $\pm V_{REF}$
- Operates from +5V and $\pm$ 12V Supplies
- Easy Serial Interface to DSP Processors
- Operating Temperature Ranges:
  - -40 deg C to +85 deg C (Ceramic DIP)
  - 0 deg C to +70 deg C (DIP and SOIC)



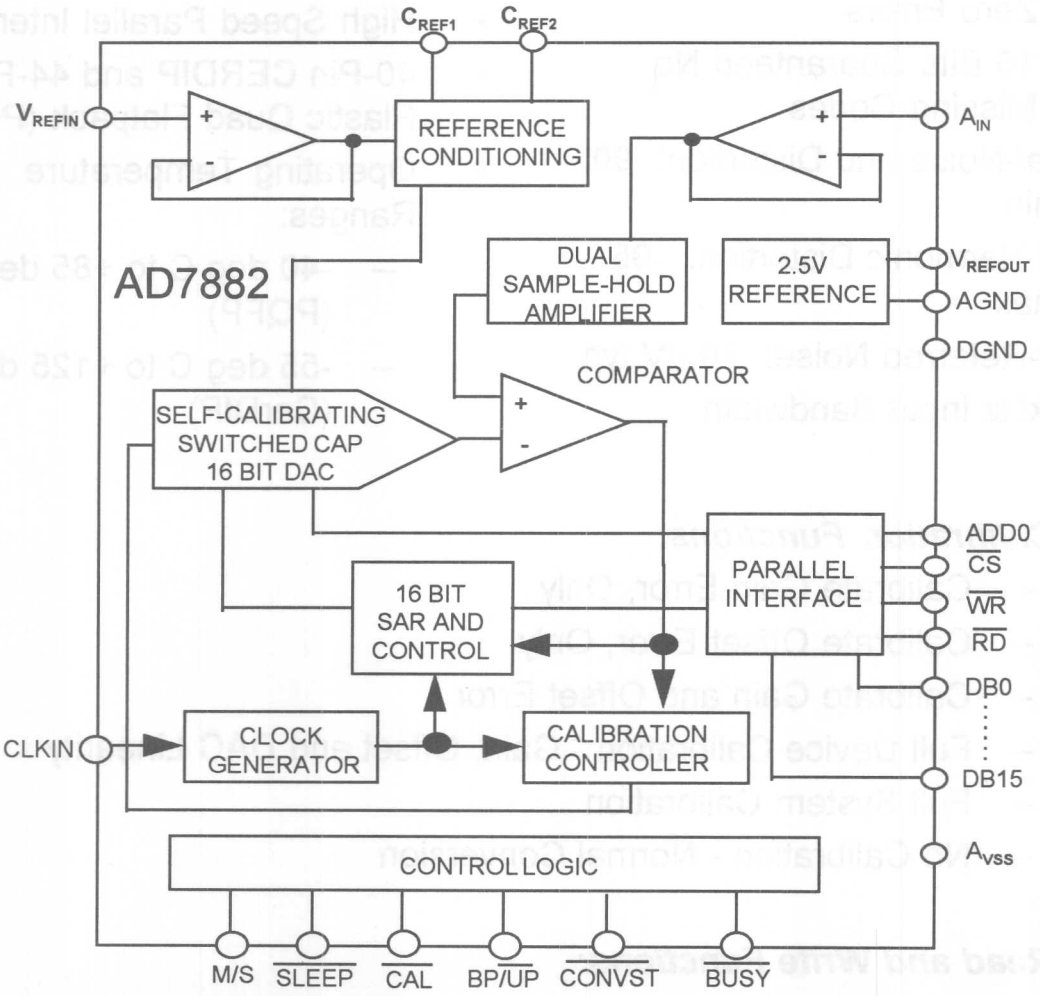
Typical DNL Performance of the AD677 at V_{REF} = 10V and F_{SAMPLE} = 1 kSPS



AD677 4096 Point FFT at F_{SAMPLE} = 100 kSPS, F_{IN} = 1 kHz and V_{REF} = 10V

AD7882*
16-Bit, 400 kSPS, Self-Calibrating A-D Converter

The AD7882's unique self-calibration feature reduces linearity, gain and offset erros to < 0.0015 percent!



*Preliminary Technical Information

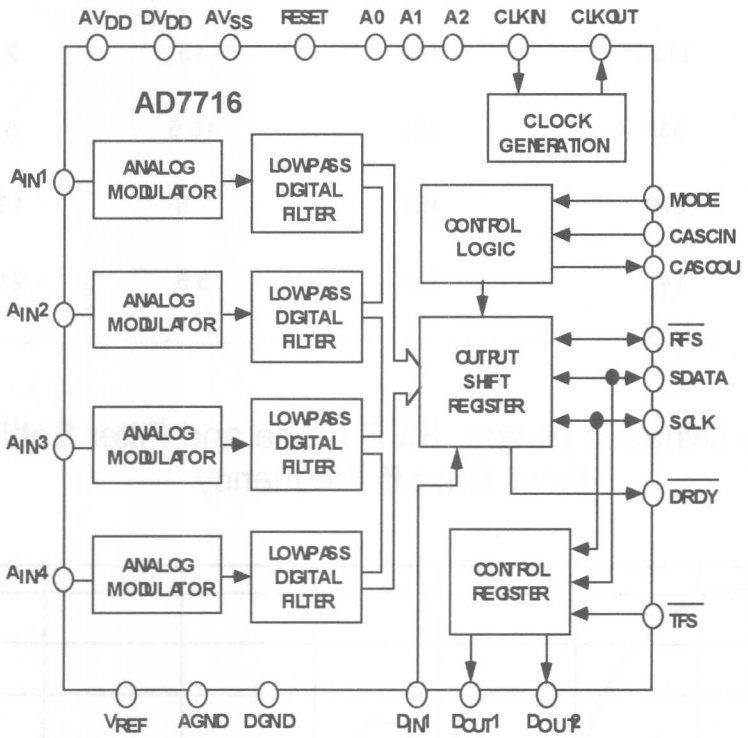
KEY SPECS AND FEATURES :

- Complete 16 Bit ADC with Sample-Hold, Reference and Clock
- Self-Calibration via On-Chip Controller Minimizes Errors:
  - ± 2 LSB max Gain and Zero Errors
  - 16 Bits Guaranteed No Missing Codes
- Signal-Noise and Distortion: 90 dB min
- Total Harmonic Distortion: -95 dB max
- Input-Referred Noise: 70 uV typ
- 200 kHz Input Bandwidth
- Analog Input Range: 0 to +2.5V or ± 2.5V
- Operates From ± 5V Supplies
  - 300 mW in Normal Mode
  - 1 mW max in Power Down Mode
- High Speed Parallel Interface
- 40-Pin CERDIP and 44-Pin Plastic Quad Flatpack (PQFP)
- Operating Temperature Ranges:
  - -40 deg C to +85 deg C (PQFP)
  - -55 deg C to +125 deg C (CerDIP)

- ***Calibration Functions:***
  - Calibrate Gain Error, Only
  - Calibrate Offset Error, Only
  - Calibrate Gain and Offset Error
  - Full Device Calibration - Gain, Offset and DAC Linearity
  - Full System Calibration
  - No Calibration - Normal Conversion

- ***Read and Write Functions:***
  - Read and Write Gain Calibration Coefficients, Only
  - Read and Write Offset Calibration Coefficients, Only
  - Read and Write All Calibration Coefficients

AD7716
20 Bit, Quad Σ – Δ A-D Converter

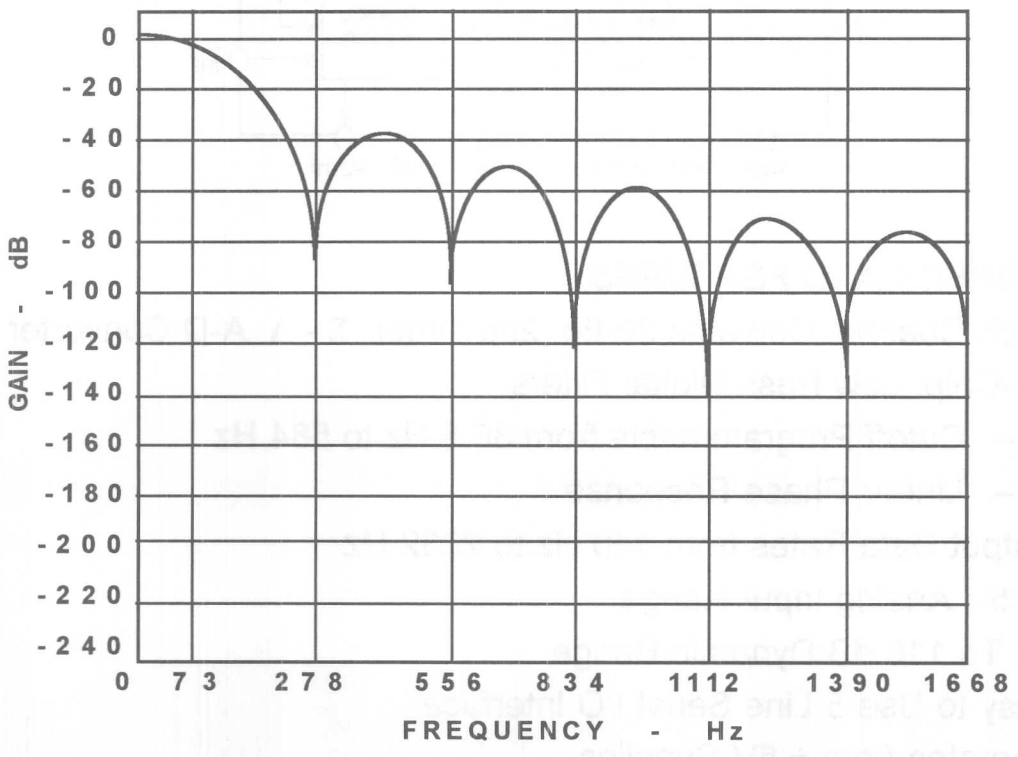


KEY SPECS AND FEATURES:

- Each Channel Contains 20-Bit, 2nd Order Σ - Δ A-D Converter
- On-Chip, Low Pass Digital Filters
  - Cutoff Programmable from 36.5 Hz to 584 Hz
  - Linear Phase Response
- Output Data Rates from 140 Hz to 2232 Hz
- ±2.5V Analog Input Range
- Up To 110 dB Dynamic Range
- Easy to Use 5 Line Serial I/O Interface
- Operates from ± 5V Supplies
- 50 mW Max Power Consumption
- 44-Pin PQFP and PLCC Packages

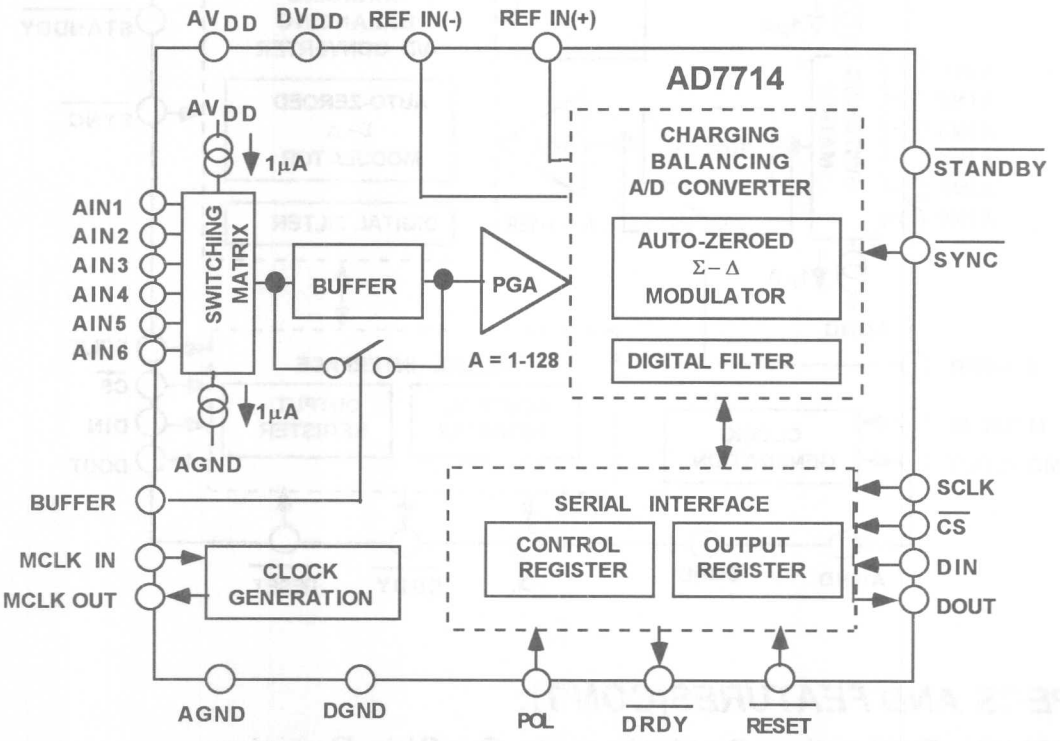
Programmed Cutoff Frequency (Hz)	Output Update Rate (Hz)	Usable Dynamic Range (dB)	RMS Noise (uV)	Filter Settling Time to + 0.0007% FS (ms)	Absolute Group Delay (ms)
584	2232	98	22	1.35	0.675
292	1116	101	15	2.7	1.35
146	558	104	10.5	5.4	2.7
73	279	107	7.5	10.8	5.4
36.5	140	110	5.5	21.6	10.8

Typical Usable Dynamic Range, RMS Noise and Filter Settling Time Vs Filter Cut-off Frequency



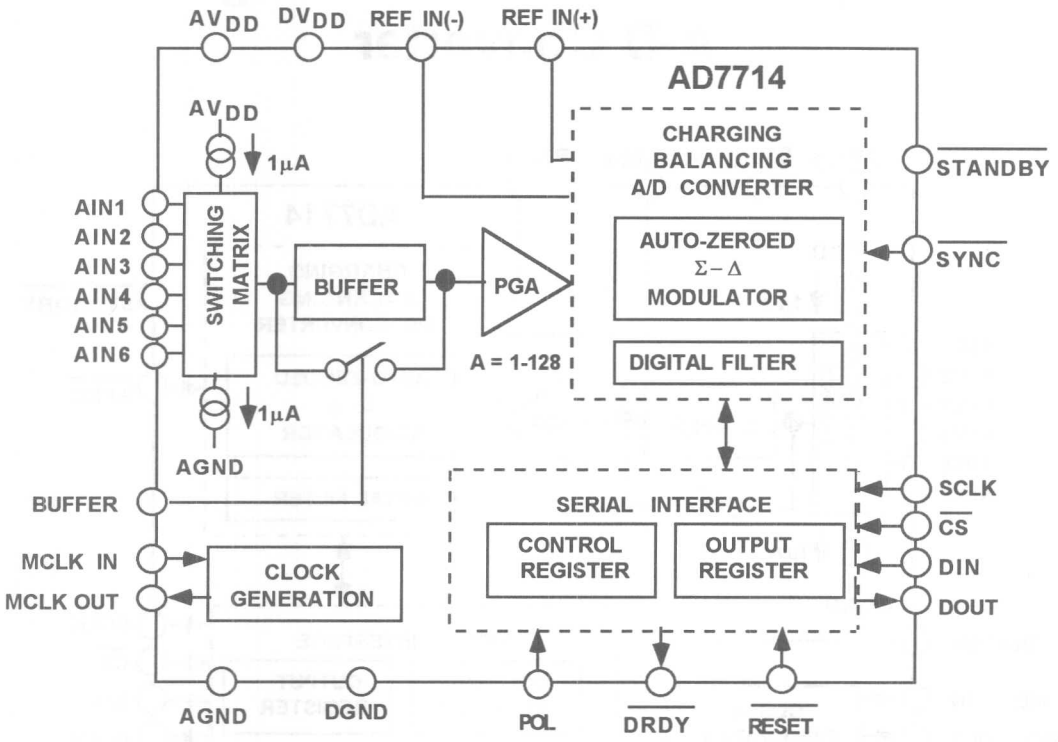
Frequency Response of the AD7716 Digital Filter

AD7714
24-Bit, 3V, Signal-Conditioning Σ - Δ A-D Converter



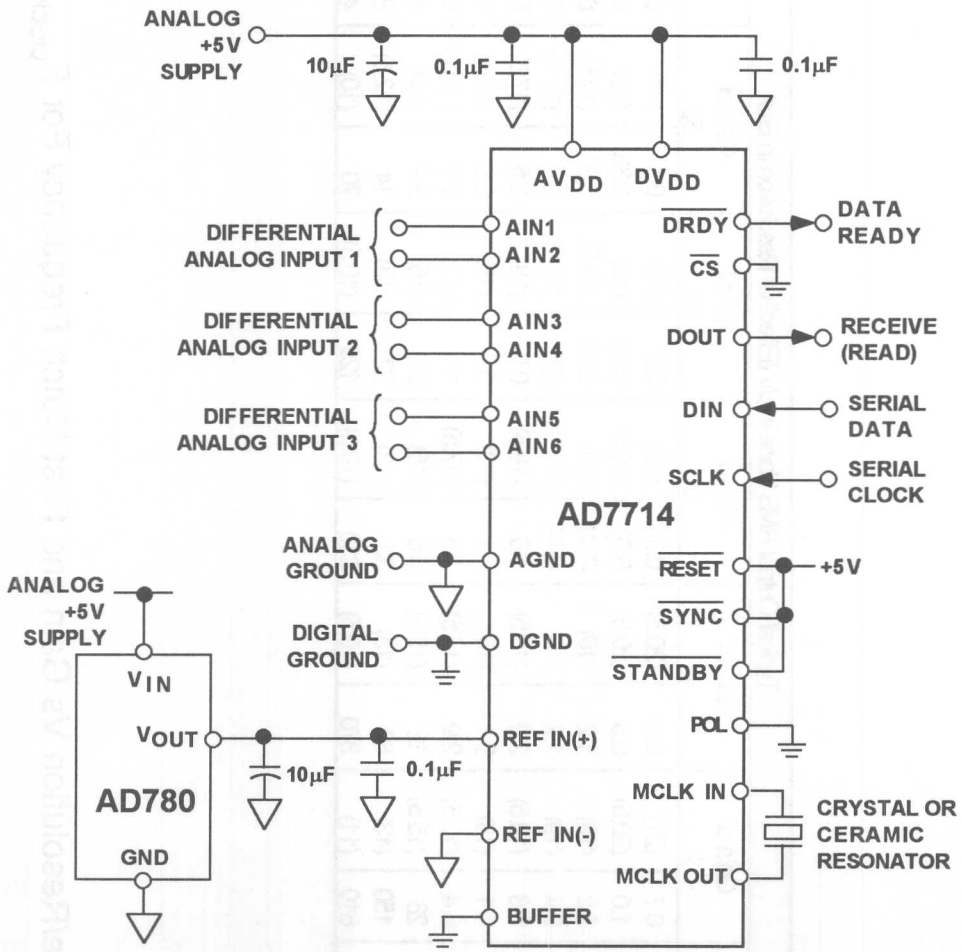
KEY SPECS AND FEATURES:

- Versatile 3 Wire Serial Interface
- 24 Bits No Missing Codes
- 5 Channel Programmable-Gain Front End:
  - Gain Range from 1 to 128
  - 3 Fully Differential or 5 Pseudo-Differential Inputs
- Programmable Digital Filter Cut-Off Settings (f_{clock} = 2.5 MHz):
  - 1.31 Hz to 262 Hz - 3dB Frequency
  - 5 Hz to 1 kHz Corresponding Output Data Rate



KEY SPECS AND FEATURES(CON'T):

- Read/Write Calibration Coefficients to On-Chip Registers
- Low Power, Single Supply Operation:
  - +3V (AD7714-3) or +5V (AD7714-5) Operation
  - 750 uW in Normal Mode, 50 uW in Power-Down Mode
- 24-Pin, 0.3" Plastic DIP, CerDIP and SOIC Packages and 28-Pin SSOP (Shrink Small Outline Package)
- Operating Temperature Ranges:
  - -40 deg C to +85 deg C (All)
  - -55 deg C to +125 deg C (SSOP)



Basic Connection Diagram

Basic Connection Diagram

Filter First Notch & O/P Data Rate	-3 dB Frequency	Typical Output RMS Noise in μV (Effective Resolution in Bits)															
		Gain of 1		Gain of 2		Gain of 4		Gain of 8		Gain of 16		Gain of 32		Gain of 64		Gain of 128	
5 Hz	1.31 Hz	1.2	(21)	0.7	(21)	0.4	(20.5)	0.3	(20)	0.3	(19)	0.3	(18)	0.3	(17)	0.3	(16)
10 Hz	2.62 Hz	1.7	(20.5)	1.0	(20.5)	0.5	(20.5)	0.36	(19.5)	0.33	(19)	0.33	(18)	0.33	(17)	0.33	(16)
25 Hz	6.55 Hz	4.9	(19)	2.2	(19)	1.2	(19)	0.60	(19)	0.36	(18.5)	0.36	(17.5)	0.36	(16.5)	0.36	(15.5)
30 Hz	7.86 Hz	5.6	(19)	2.4	(19)	1.2	(19)	0.84	(18.5)	0.5	(18.5)	0.4	(17.5)	0.4	(16.5)	0.4	(15.5)
50 Hz	13.1 Hz	7.5	(18.5)	3.8	(18.5)	2.0	(18.5)	1.0	(18.5)	0.6	(18)	0.5	(17.5)	0.5	(16.5)	0.45	(15.5)
60 Hz	15.72 Hz	8.5	(18)	4.1	(18)	2.1	(18)	1.1	(18)	0.6	(18)	0.5	(17.5)	0.5	(16.5)	0.45	(15.5)
100 Hz	26.2 Hz	13	(17.5)	6.4	(17.5)	2.9	(17.5)	1.5	(17.5)	1.1	(17)	0.7	(17)	0.65	(16)	0.65	(15)
250 Hz	65.5 Hz	53	(15.5)	28	(15.5)	12	(15.5)	8.6	(15)	3.9	(15)	3.7	(14)	1.9	(14)	1.4	(14)
500 Hz	131 Hz	240	(13.5)	150	(13)	80	(13)	35	(13)	22	(13)	14	(12.5)	8.7	(12)	8	(11.5)
1 kHz	262 Hz	1400	(11)	610	(11)	370	(10.5)	230	(10.5)	125	(10.5)	70	(10)	40	(10)	22	(10)

AD7714-3 Output Noise/Resolution Vs Gain and First Notch Frequency For F_{clock} = 2.4576 Mhz

SECTION 4
DIGITAL-TO-ANALOG CONVERTERS

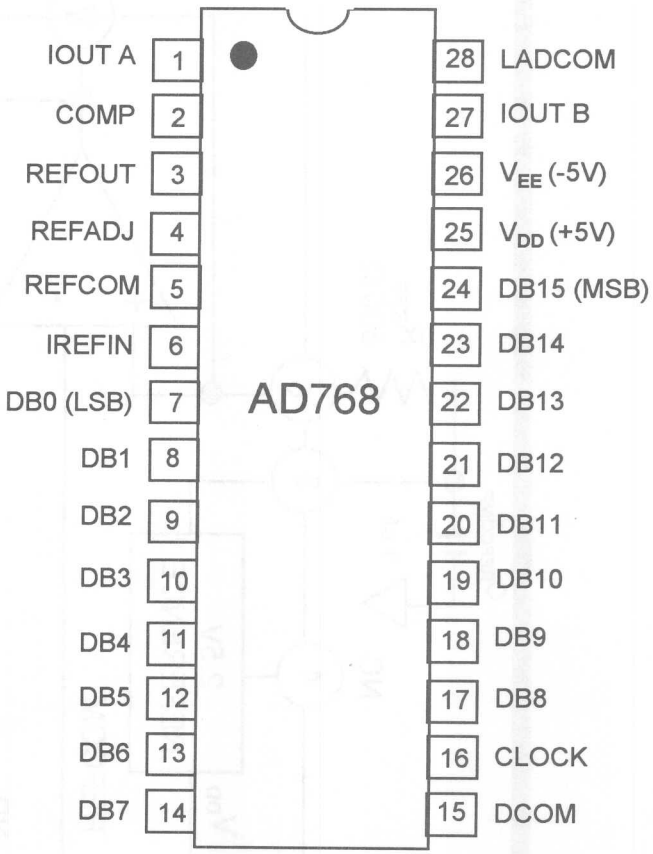
High Speed D-A Converters
High Resolution D-A Converters
Single Supply, Generel Purpose D-A Converters
Dual, Quad and Octal D-A Converters

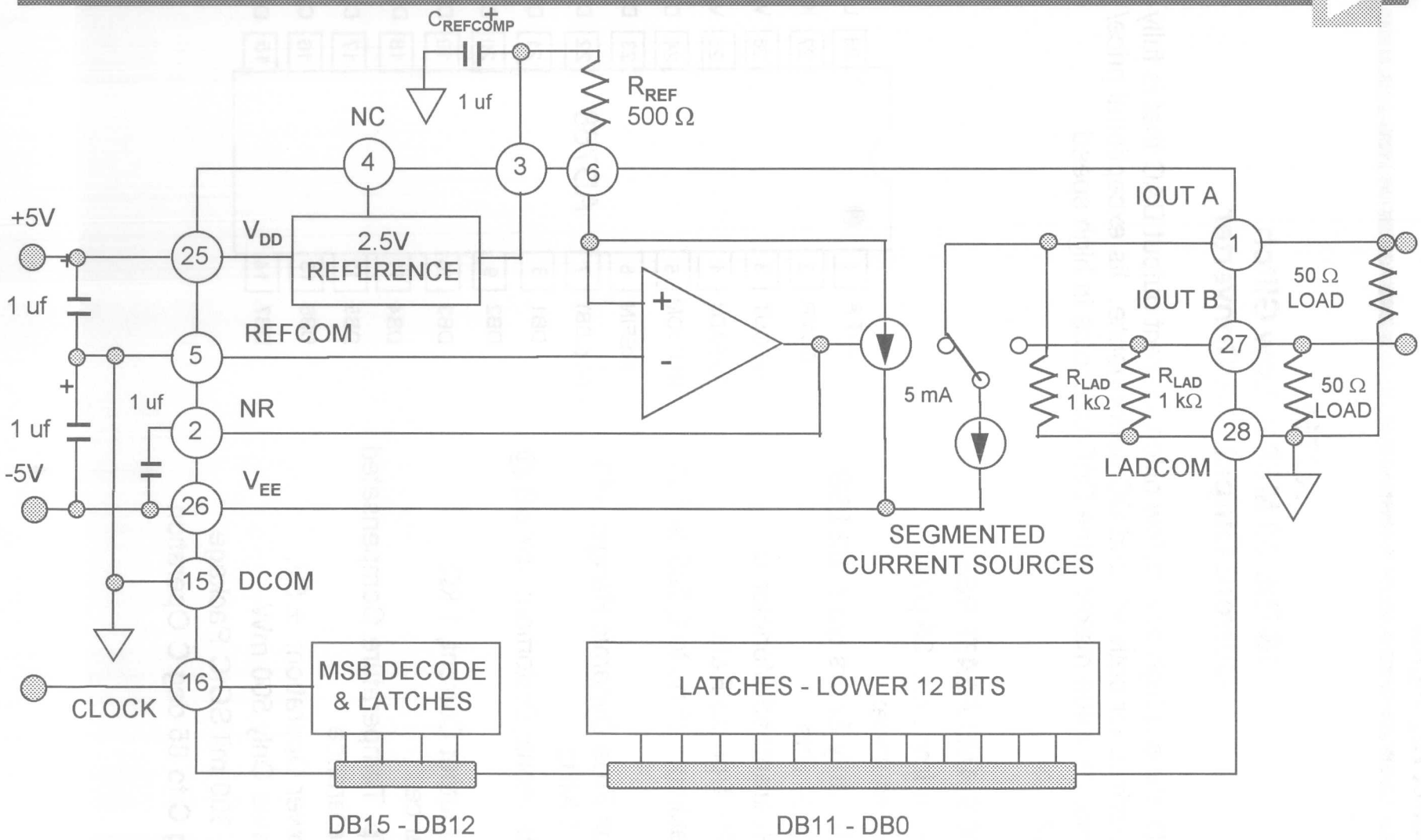
AD768
16-Bit, 30 MSPS, Low Glitch Current Output D-A Converter

The AD768 is a high speed, low glitch, current output DAC that is fully characterized for both AC and DC performance. Its exceptional price/ performance value makes it the DAC of choice in high speed applications.

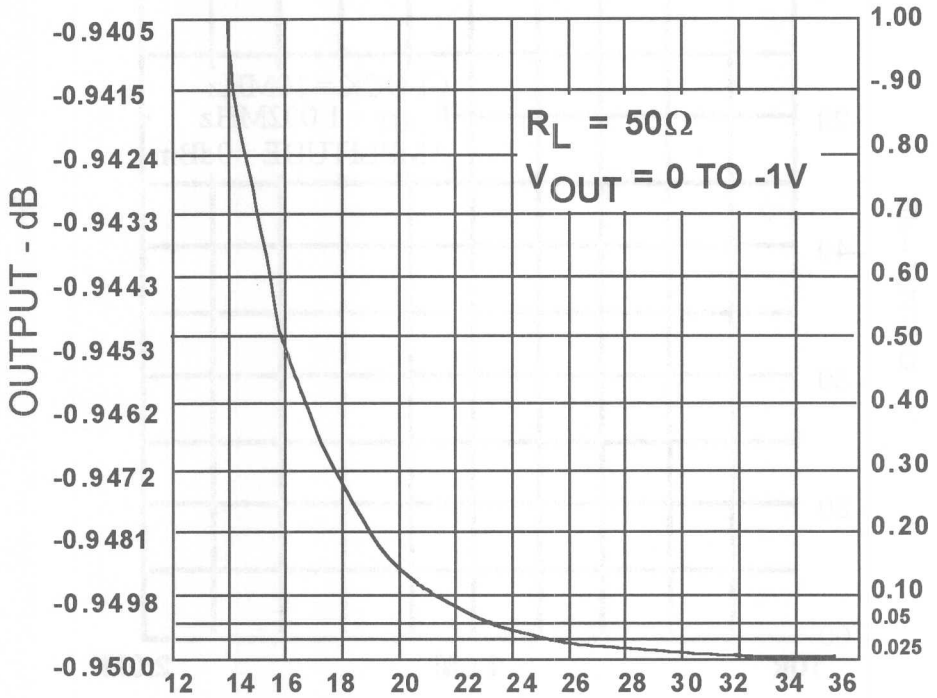
KEY SPECS AND FEATURES:

- Low Glitch Impulse: 35 pV-s
- DC Performance:
  - » Linearity Errors typ ± 1/2 LSB @ 14 Bits
  - » Guaranteed Monotonic
- 30 MSPS Update Rate
- Fast Settling: 25 ns to 0.025 % Full Scale
- Spurious Free Dynamic Range: -83 dBc @ 1 MHz
- Total Harmonic Distortion: -67 dB @ 1 MHz
- 20 mA Output Current, 1 kΩ Impedance
- On-Chip, Temperature Compensated 2.5V Reference
- Low Power Operation: ± 5V, Consumes Only 500 mW
- 28-Pin, 300 mil SOIC Package
- -40 deg C to 85 deg C Operation

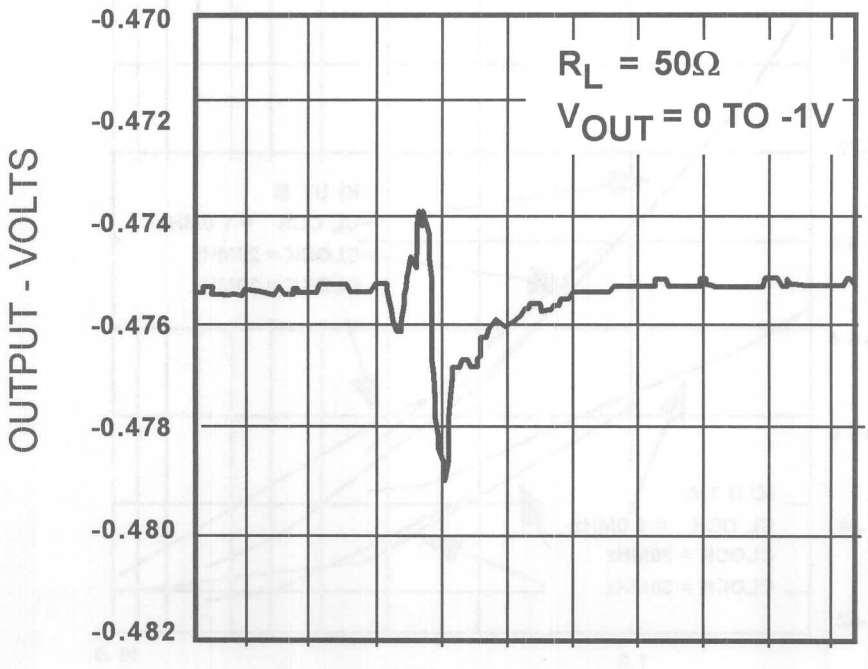




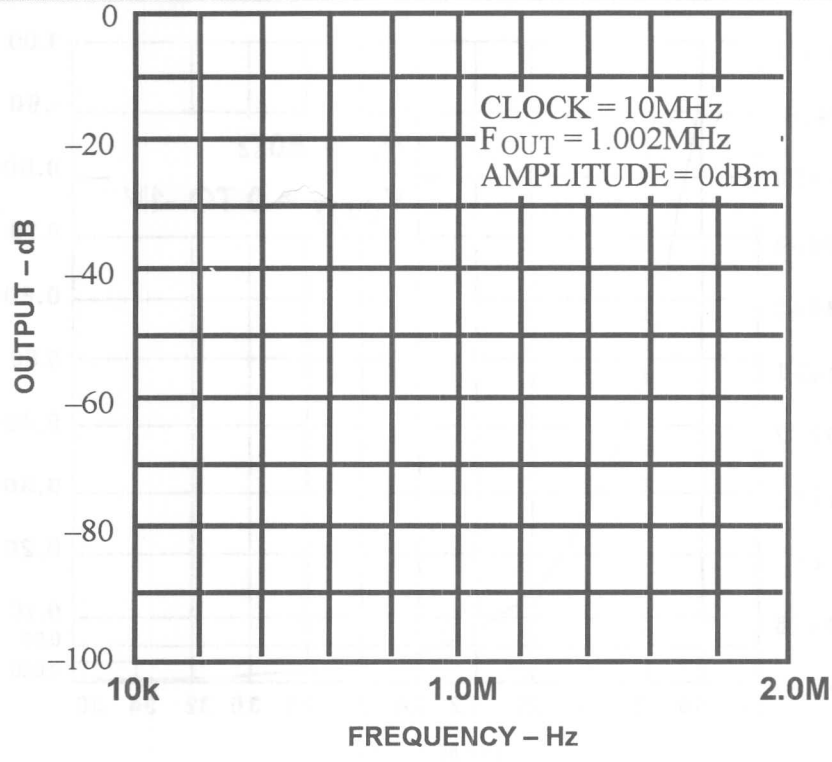
Functional Block Diagram and Basic Hookup



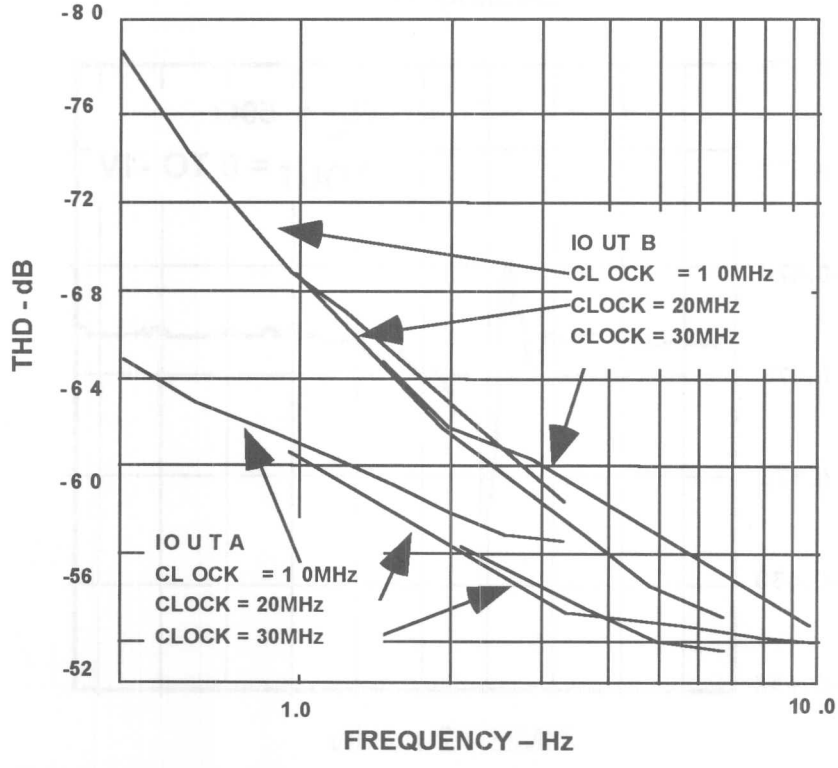
Settling Time



Glitch Impulse at Major Carry



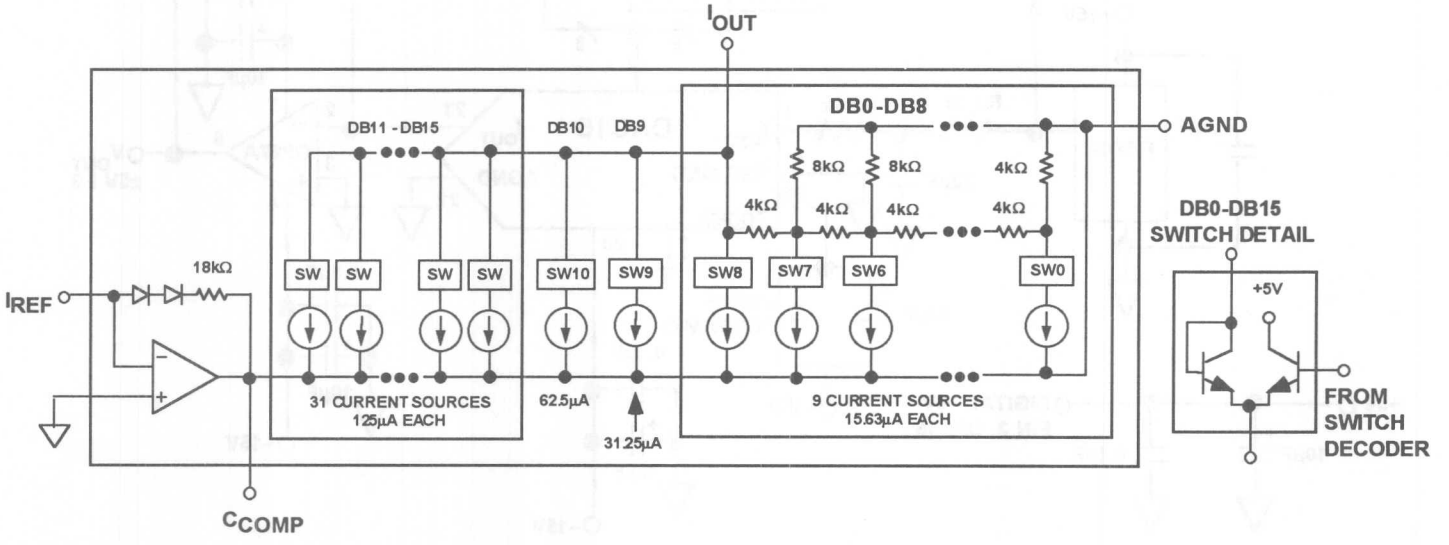
Spurious-Free Dynamic Range



Total Harmonic Distortion vs Input Frequency

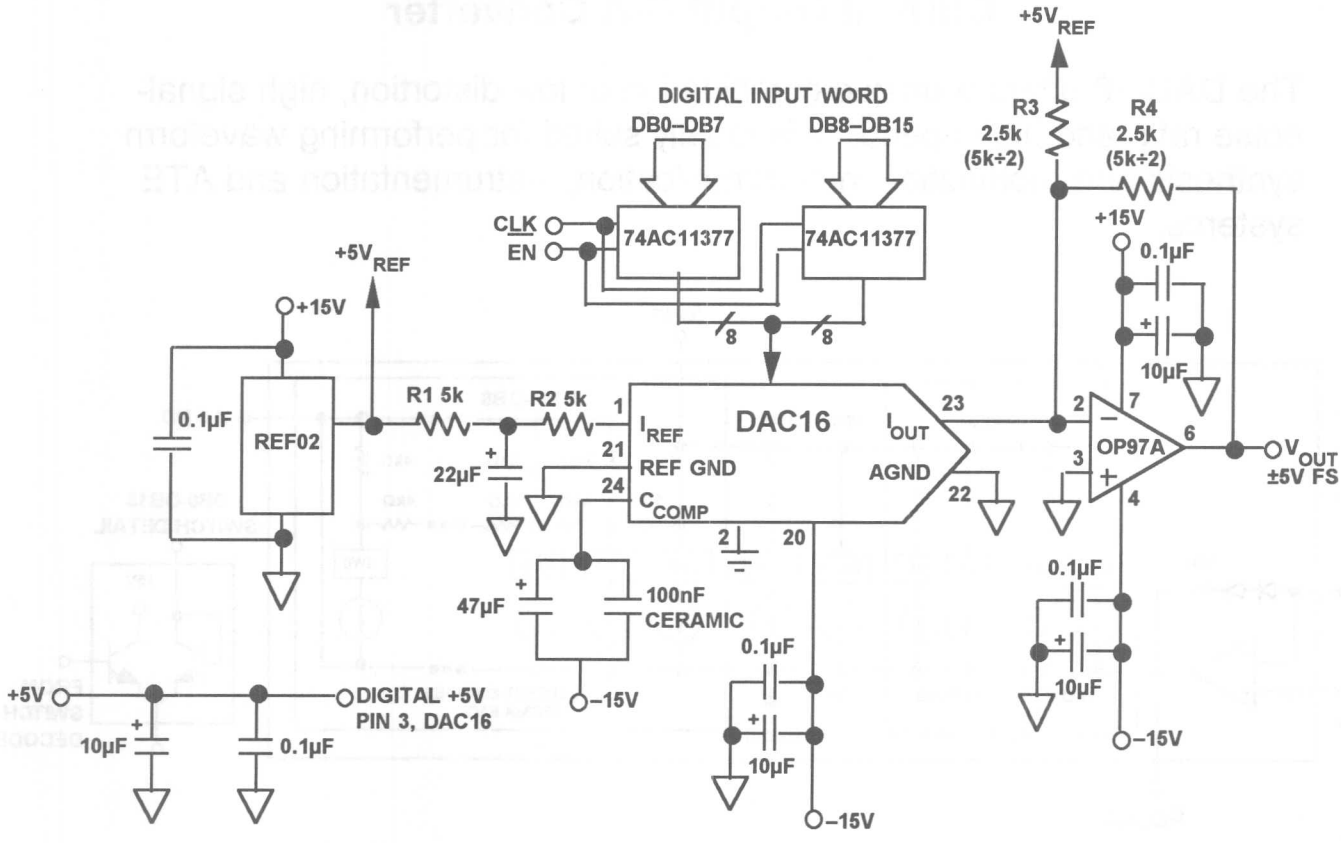
DAC-16
16-Bit, 500 ns, Low Noise Current Output D-A Converter

The DAC-16 offers a unique combination of low distortion, high signal-noise ratio and high speed. It is ideally suited for performing waveform synthesis and modulation in communication, instrumentation and ATE systems.



KEY SPECS AND FEATURES:

- Guaranteed 16 Bit Monotonic Over Temperature
- High Speed: 500 ns Settling Time to 0.003 % FS
- Output Noise Spectral Density: 31 pA/√ Hz @ 1 kHz
- 5 mA Full Scale Output
- TTL/CMOS Compatible
- Low Power: Only 190 mW typ, + 5V and -15V Supplies
- Choice of 24-Pin DIP (Plastic and Side Brazed), 24-Pin SOIC and 28-Lead Hermetic LCC Packages
- Available in DIE Form



RESISTORS: CADDOCK T912–5K–010–02 (OR EQUIVALENT):
5K, 0.01%, TC TRACK = 2Ppm/°C

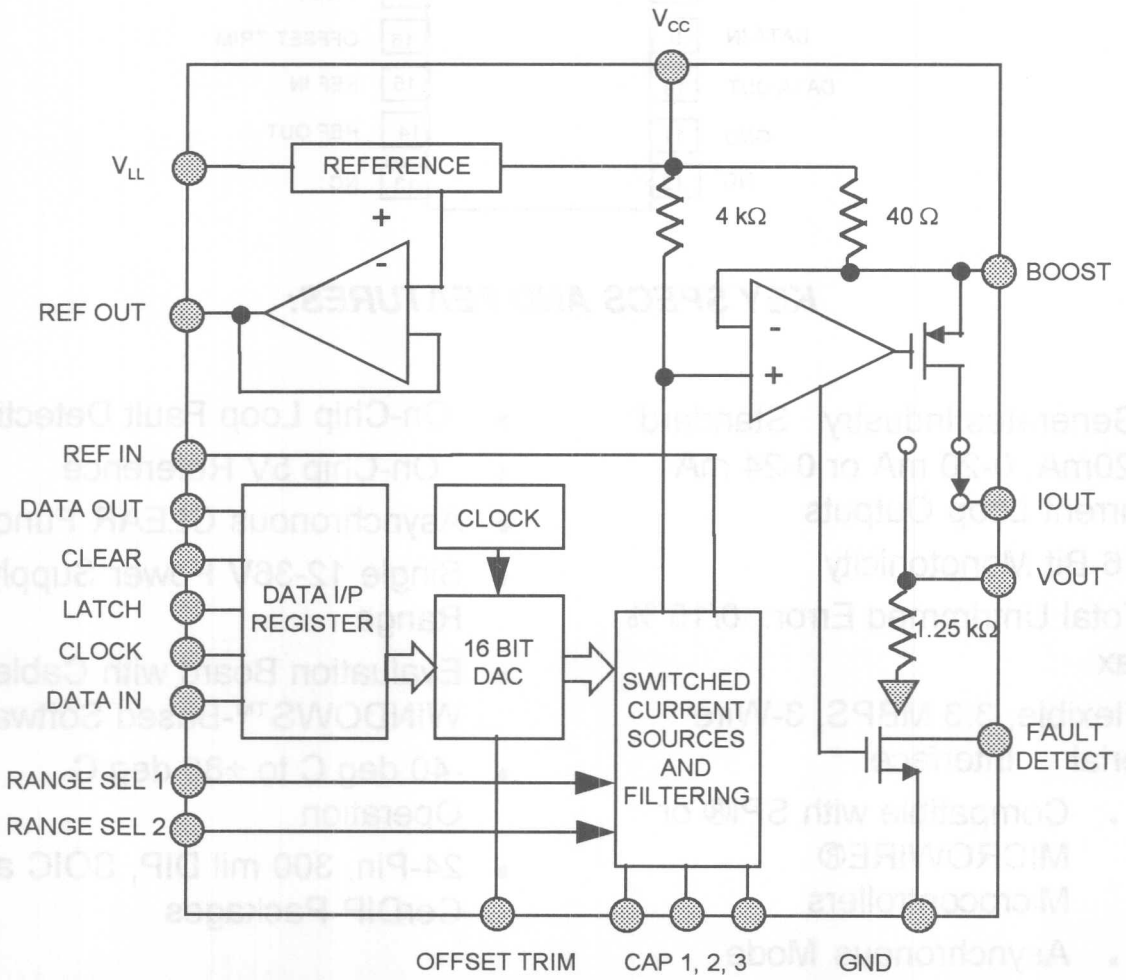
Unipolar Mode : R3 = open, R4 = 1.25k
Bipolar Mode : R3 = 2.5k, R4 = 2.5k

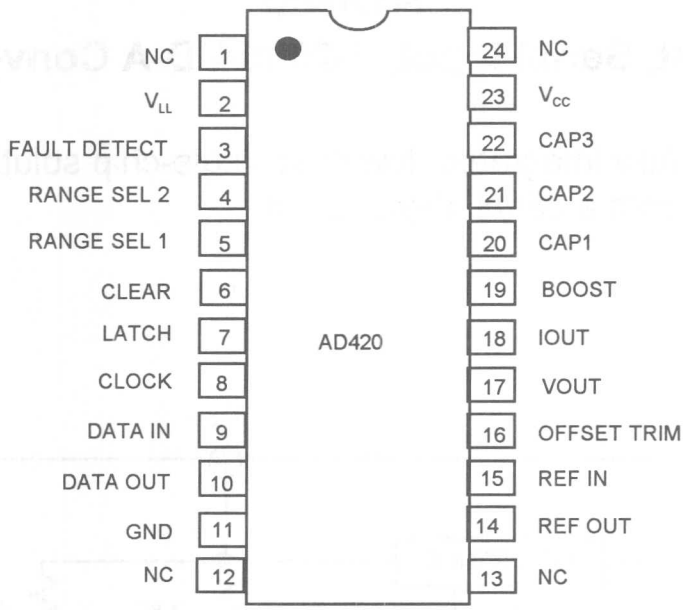
Unipolar and Bipolar Circuit Configuration

AD420

16-Bit, Serial Input, 4-20 mA D-A Converter

The AD420 offers a fully integrated, low cost single-chip solution for generating current loop signals from a serial, digital input.

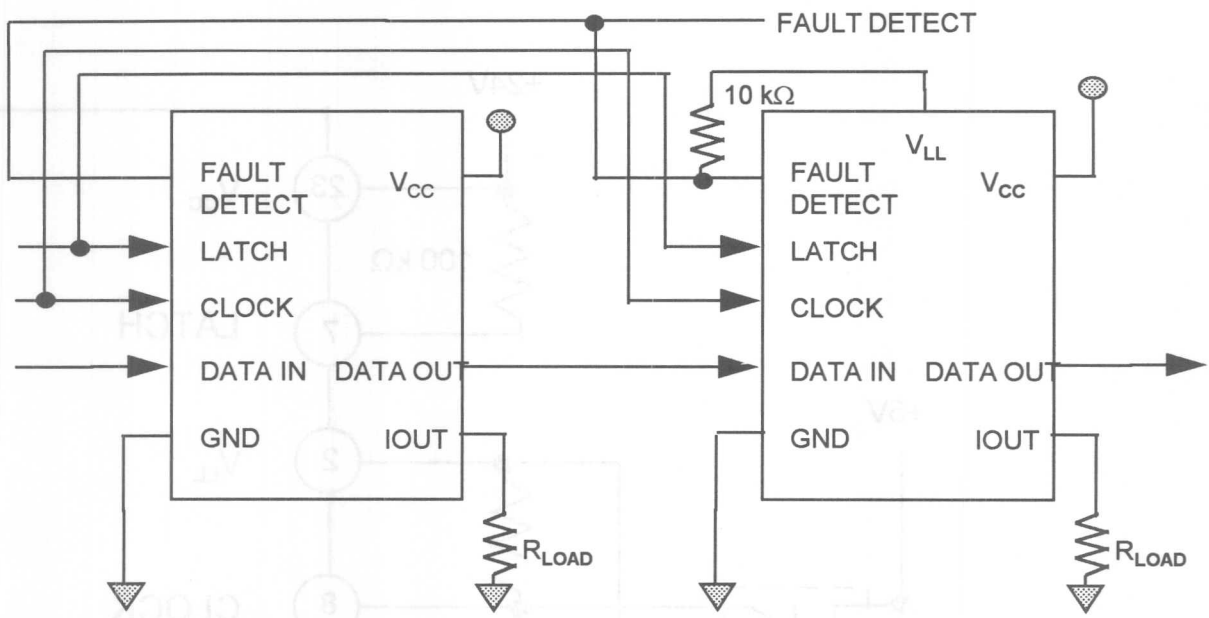




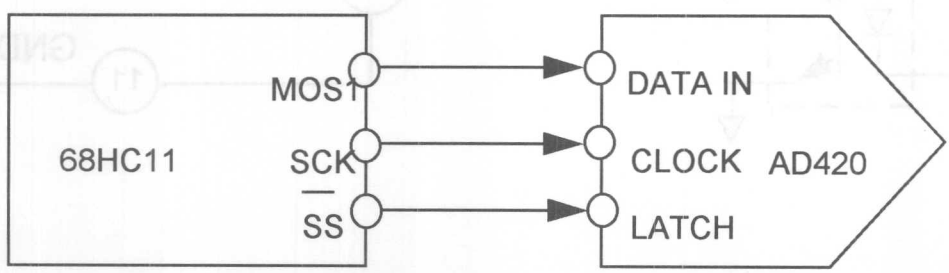
KEY SPECS AND FEATURES:

- Generates Industry Standard 4-20mA, 0-20 mA or 0-24 mA Current Loop Outputs
- 16-Bit Monotonicity
- Total Untrimmed Error: 0/15 % max
- Flexible, 3.3 MBPS, 3-Wire Serial Interface:
  - » Compatible with SPI® or MICROWIRE® Microcontrollers
  - » Asynchronous Mode
- On-Chip Loop Fault Detection
- On-Chip 5V Reference
- Asynchronous CLEAR Function
- Single 12-36V Power Supply Range
- Evaluation Board with Cable and WINDOWS™-Based Software
- -40 deg C to +85 deg C Operation
- 24-Pin, 300 mil DIP, SOIC and CerDIP Packages

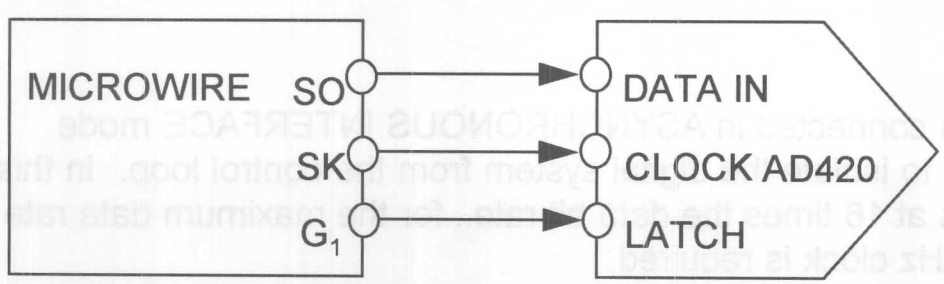
SPI is a registered trademark of Motorola
MICROWIRE is a registered trademark of National Semiconductor



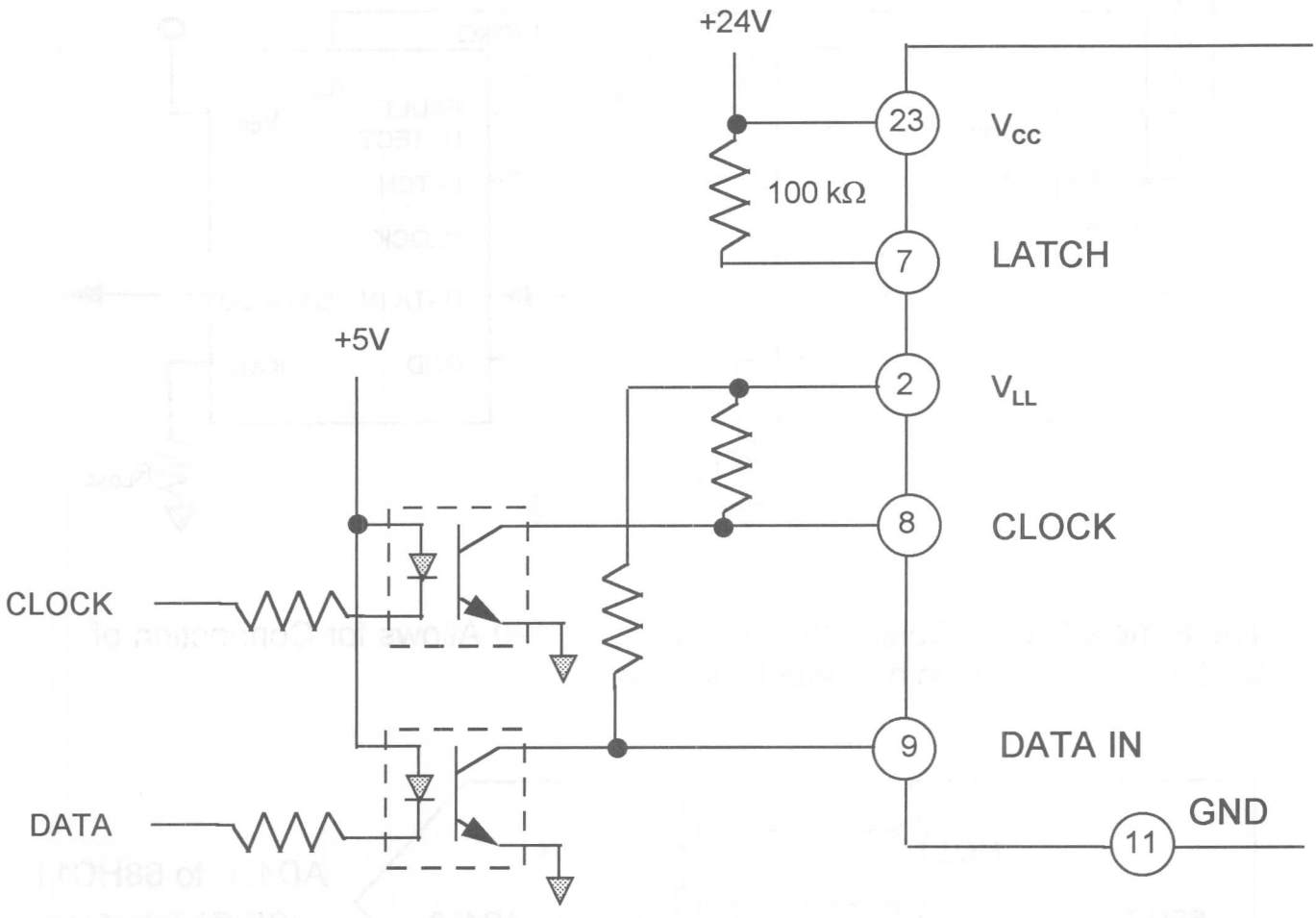
The Simple 3-Wire Serial Interface of the AD420 Allows for Connection of Multiple Dacs With Joint Fault Detection



AD420 to 68HC11 (SPI®) Interface



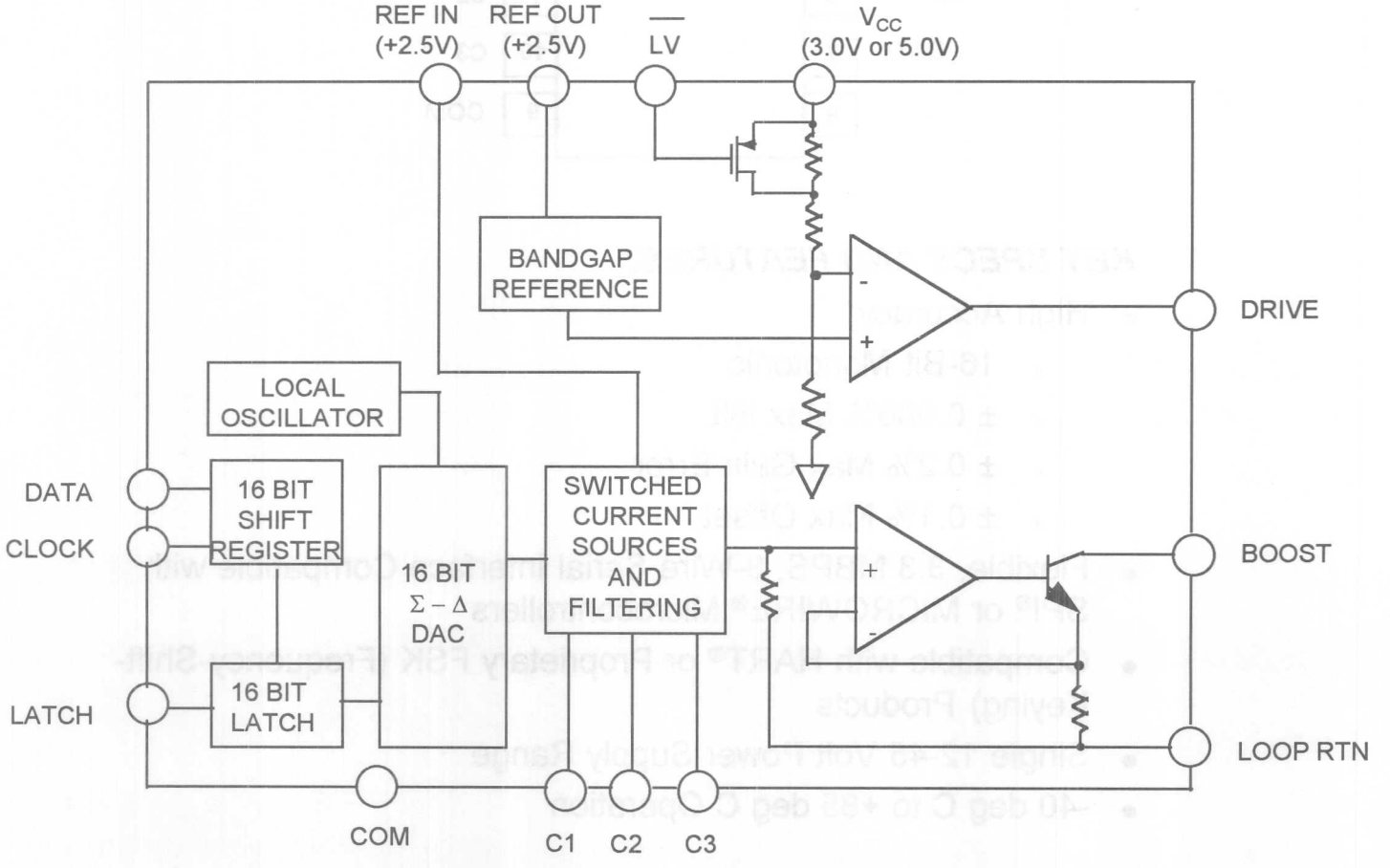
AD420 to MICROWIRE® Interface



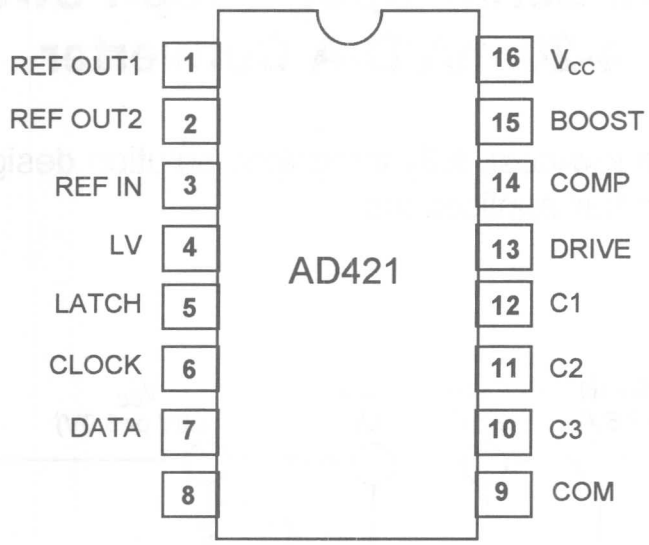
The AD420 is shown connected in ASYNCHRONOUS INTERFACE mode using Opto-Couplers to isolate the digital system from the control loop. In this mode, the clock runs at 16 times the data bit rate...for the maximum data rate of 150 kbps, a 2.4 MHz clock is required.

AD421
16-Bit, Serial Input, Loop-Powered 4-20 mA D-A Converter

The AD421 is a low-cost, fully integrated solution designed for "Smart" Transmitter applications.



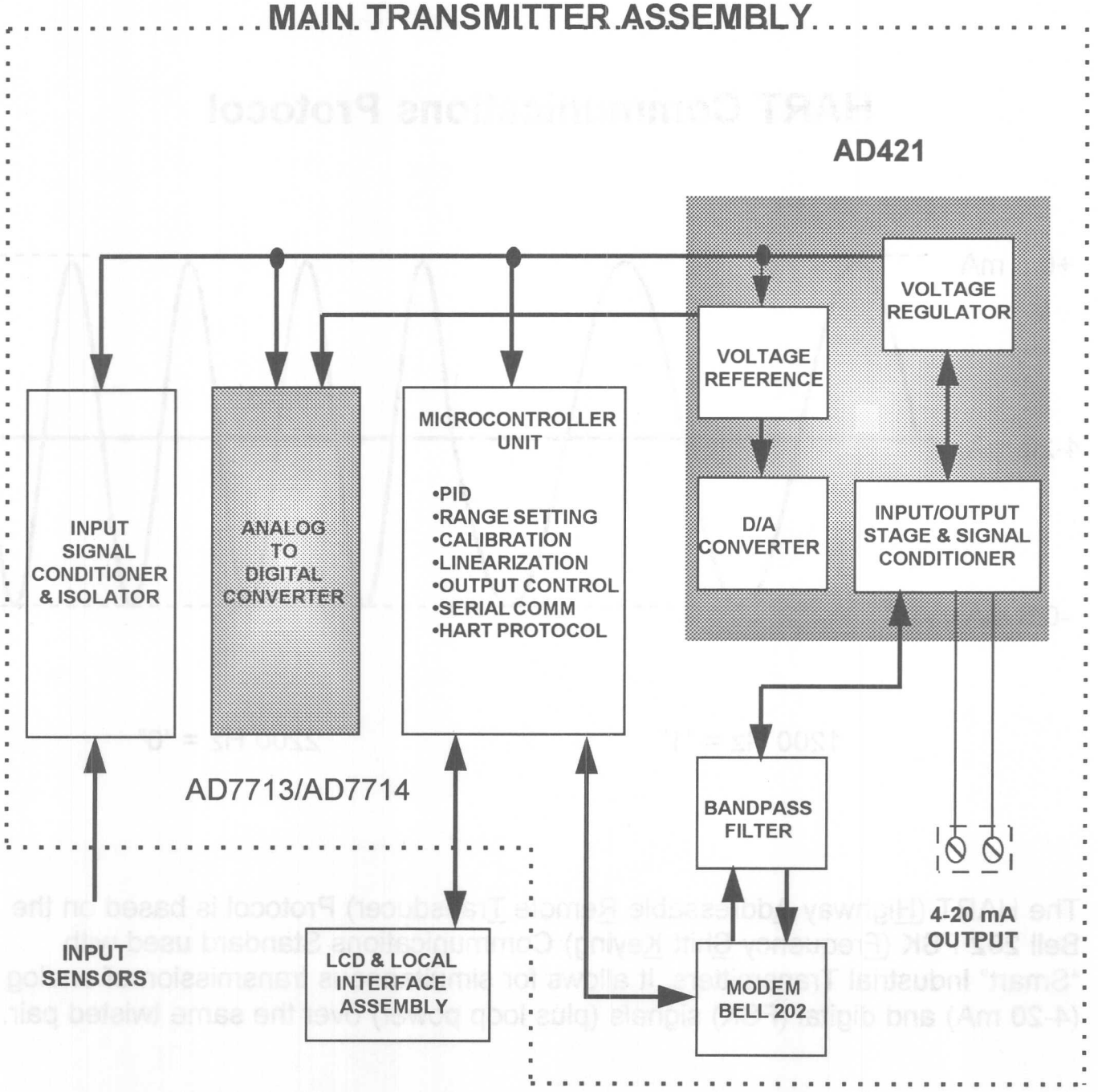
16-Pin SOIC and PDIP Packages



KEY SPECS AND FEATURES:

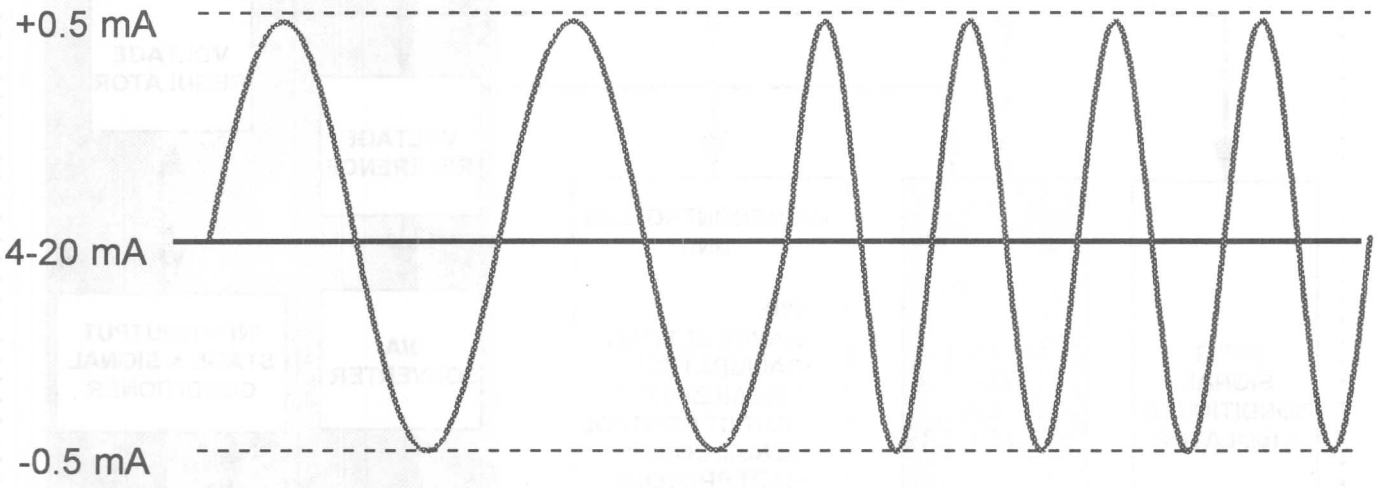
- High Accuracy:
  - 16-Bit Monotonic
  - ± 0.006% Max INL
  - ± 0.2% Max Gain Error
  - ± 0.1% Max Offset
- Flexible, 3.3 MBPS, 3-Wire Serial Interface Compatible with SPI® or MICROWIRE® Microcontrollers
- Compatible with HART® or Proprietary FSK (Frequency-Shift-Keying) Products
- Single 12-45 Volt Power Supply Range
- -40 deg C to +85 deg C Operation

HART is a registered trademark of the HART User Group
SPI is a registered trademark of Motorola
MICROWIRE is a registered trademark of National Semiconductor



A "Smart" Transmitter contains a microcontroller unit and has the ability to self-calibrate, set measurement ranges, run self-diagnostics and communicate with a host controller.

HART Communications Protocol

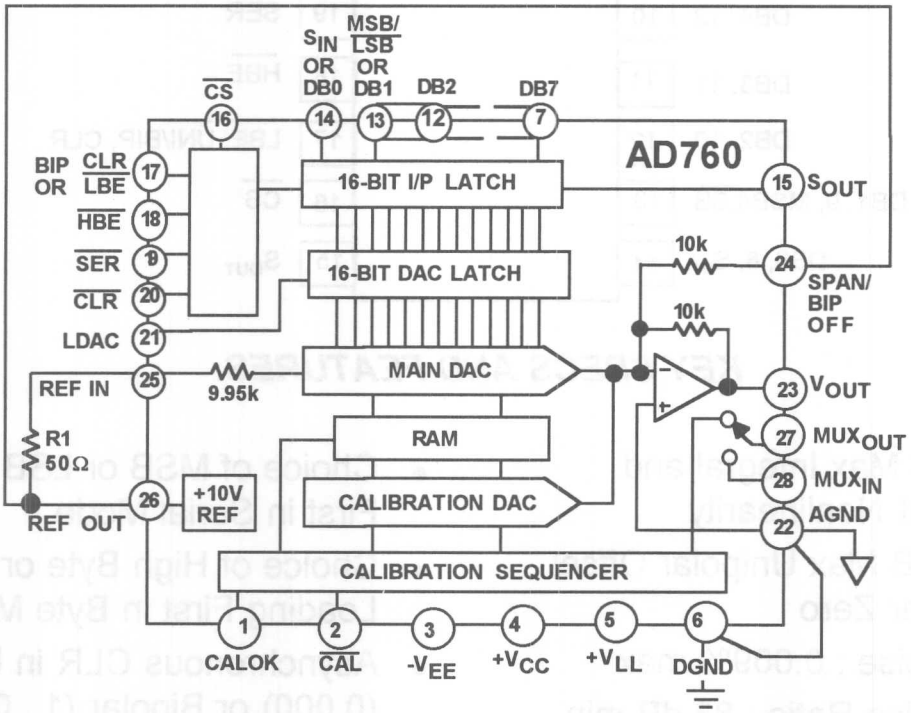


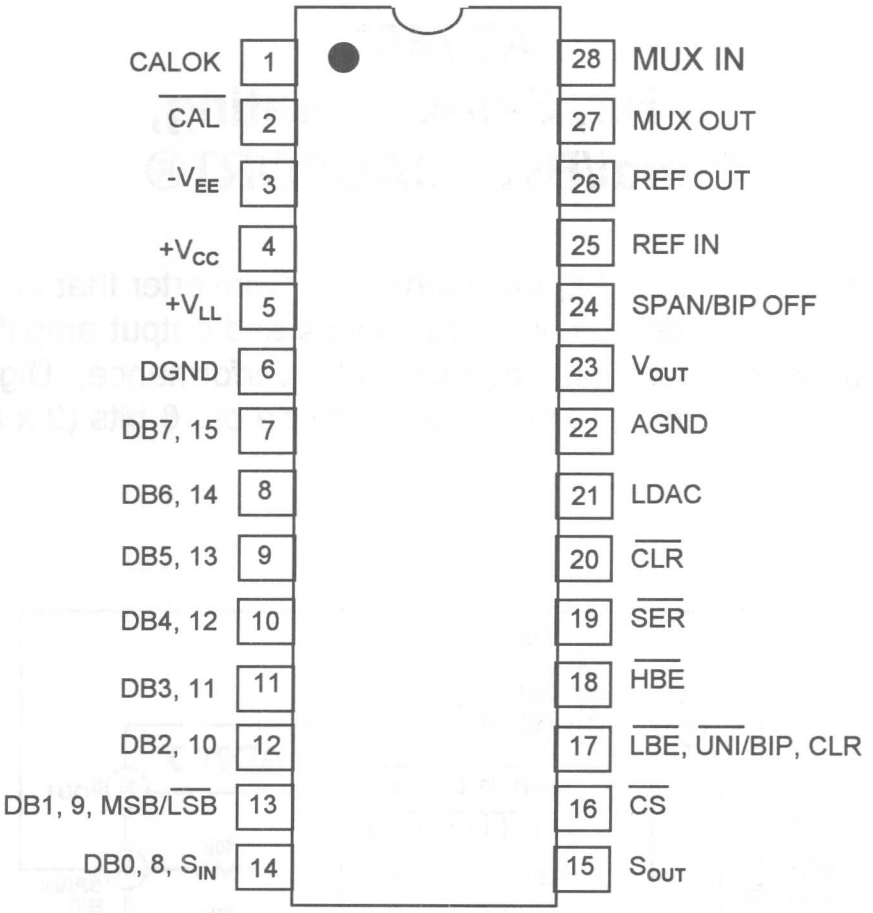
1200 Hz = "1" 2200 Hz = "0"

The HART (Highway Addressable Remote Transducer) Protocol is based on the Bell 202 FSK (Frequency Shift Keying) Communications Standard used with "Smart" Industrial Transmitters. It allows for simultaneous transmission of analog (4-20 mA) and digital (FSK) signals (plus loop power) over the same twisted pair.

AD760*
16-Bit, Self-Calibrating, Serial/Byte DACPORT®

The AD760 is a complete, 16 bit, monolithic D-A Converter that includes an on-board voltage reference, double-buffered latches and output amplifier. Self-calibration via user command insures true 16 bit performance. Digital input data may be loaded as either 18 bits in serial mode or 16 bits (2 x 8 bit) in byte mode.



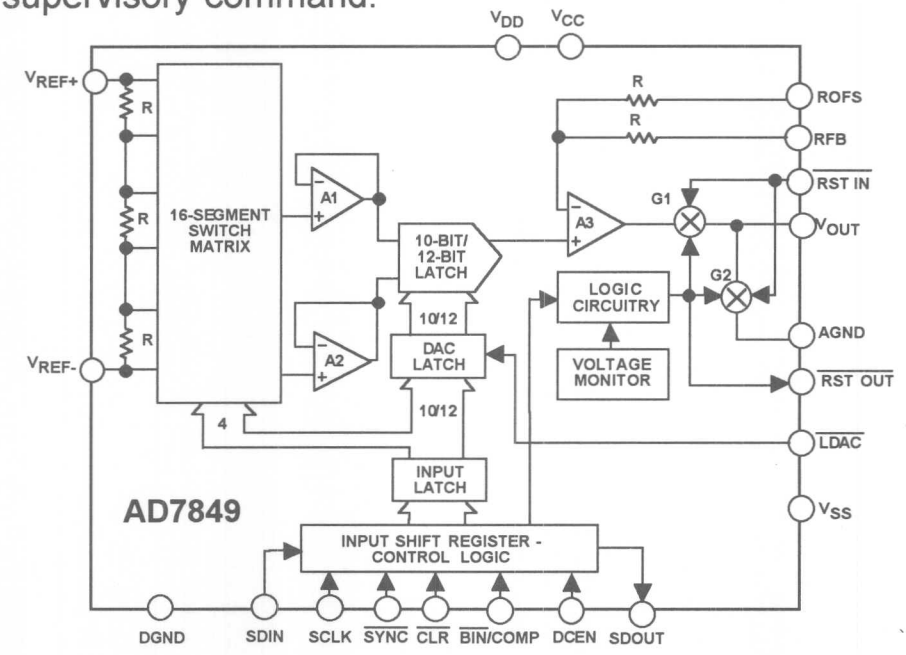


KEY SPECS AND FEATURES:

- ± 0.5 LSB Max Integral and Differential Nonlinearity
- ± 0.25 LSB Max Unipolar Offset and Bipolar Zero
- THD & Noise : 0.009% max
- Signal-Noise Ratio : 83 dB min
- Pin-Strappable Unipolar (+ 10V) or Bipolar (± 10V) Output
- Pin-Programmable Serial or Byte Mode Interface
- Choice of MSB or LSB Loading First in Serial Mode
- Choice of High Byte or Low Byte Loading First in Byte Mode
- Asynchronous CLR in Unipolar (0.000) or Bipolar (1...000) Zero
- Output Control on Power Up or Power Down
- 28-Pin Plastic DIP, Sidebrazed DIP and PLCC Packages

AD7849
14/16-Bit, Voltage Output Serial D-A Converter

The AD7849 is ideally suited for process control applications where it is desirable for the DAC output to automatically reset to zero during power-up or power down sequences until the power supplies stabilize and a valid word is written to the DAC register. The output may also be reset to zero via an external uP supervisory command.

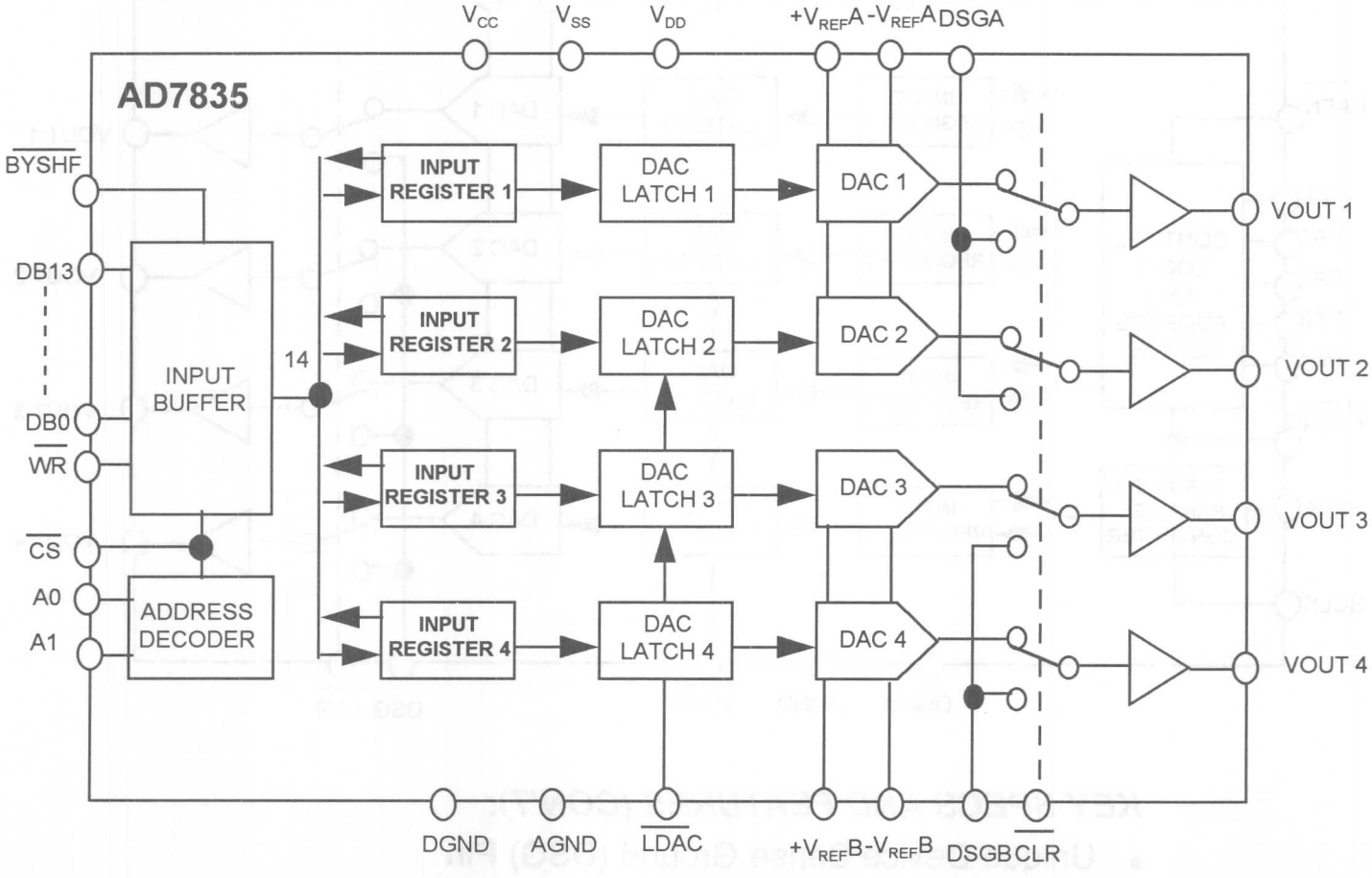


KEY SPECS AND FEATURES:

- Guaranteed Monotonic:
  - 14 Bits: "A" grade
  - 16 Bits: "B, C and T" grades
- Stand-Alone or Daisy Chain Serial Interface Modes
- Programmable Binary or 2's Complement Coding
- ± 15V and + 5V Supplies
- Low Power Dissipation: 100 mW
- 20-Pin DIP and SOIC Packages

**Preliminary Technical Information*

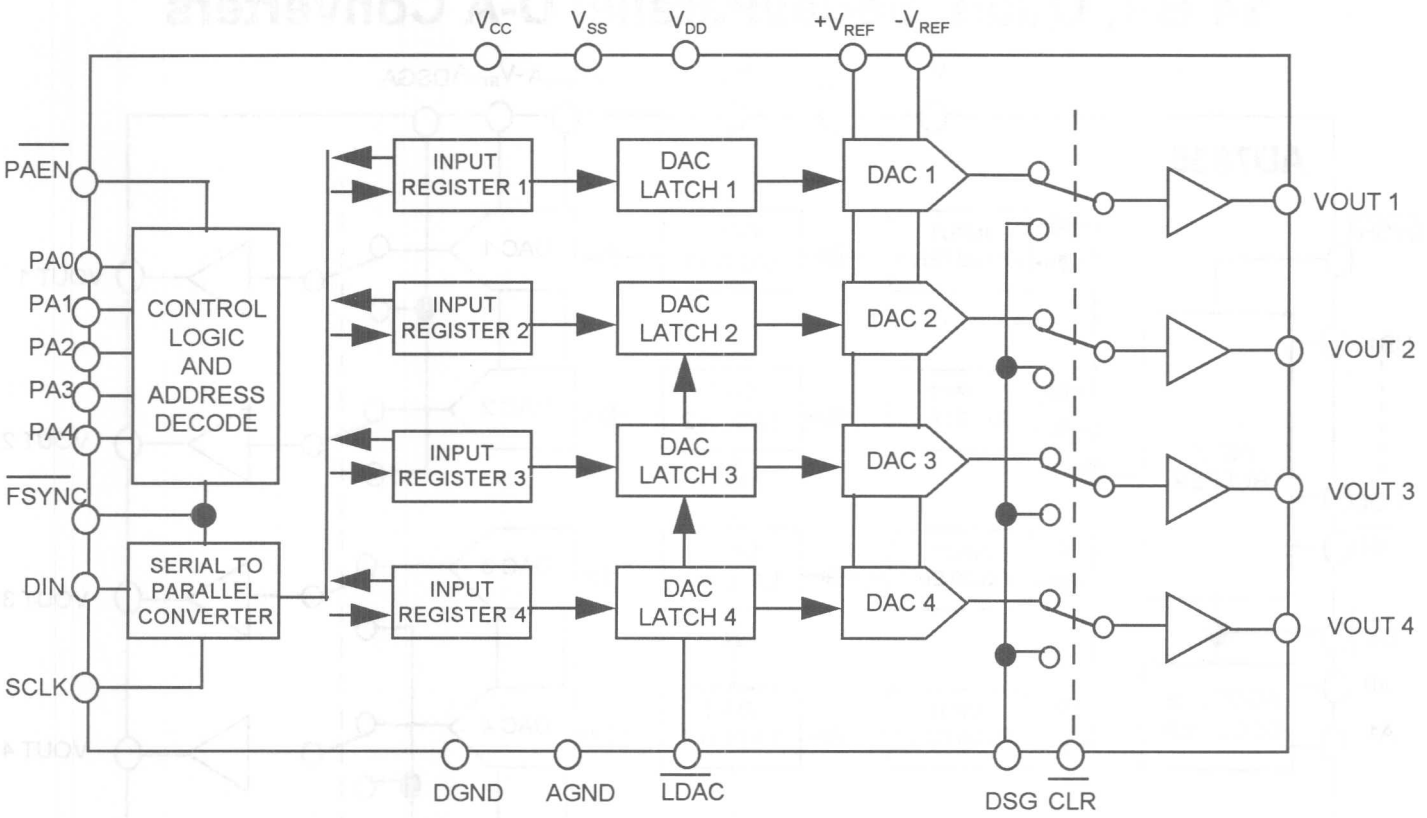
AD7834*/AD7835*
14 Bit, Quad, Serial/Parallel D-A Converters



KEY SPECS AND FEATURES:

- Four (4) 14-bit DACs on one monolithic chip!
  - AD7834 : 16 Bit Serial Load
  - AD7835 : 14 Bit Parallel or 8 Bit Byte
- Simultaneous or Individual Update of DACs
- Voltage Outputs : $(+V_{REF})$ - $(-V_{REF})$
- Maximum Output Voltage : $\pm$ 8V

**Preliminary Technical Information*

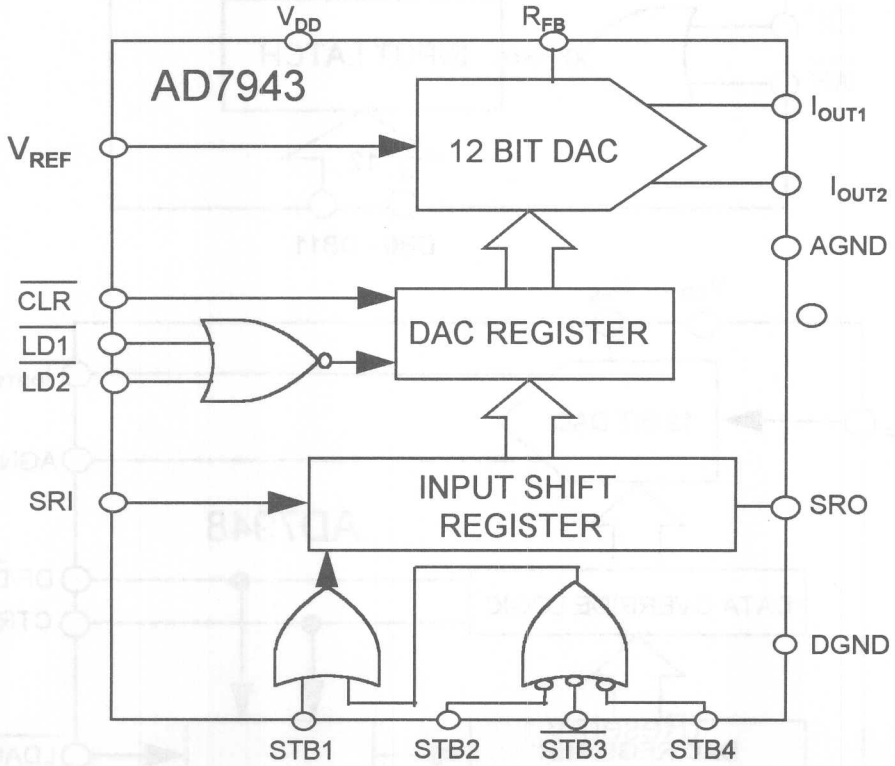


KEY SPECS AND FEATURES (CON'T):

- Unique Device Sense Ground (DSG) Pin
  - » CLR (Reset) V_{out} Levels to DSG Value
  - » At Power On, Holds V_{out} at DSG $\pm$ 2 Volts Until Supplies Stabilize
- Requires +5V and $\pm$15V Supplies
- Packages:
  - » AD7834 : 28 Pin DIP, CerDIP and SOIC
  - » AD7835 : 44 Pin PLCC and PQFP
- Operating Temperature Ranges:
  - » -40 deg C to +85 deg C (all except CerDIP)
  - » -55 deg C to +125 deg C (CerDIP only)

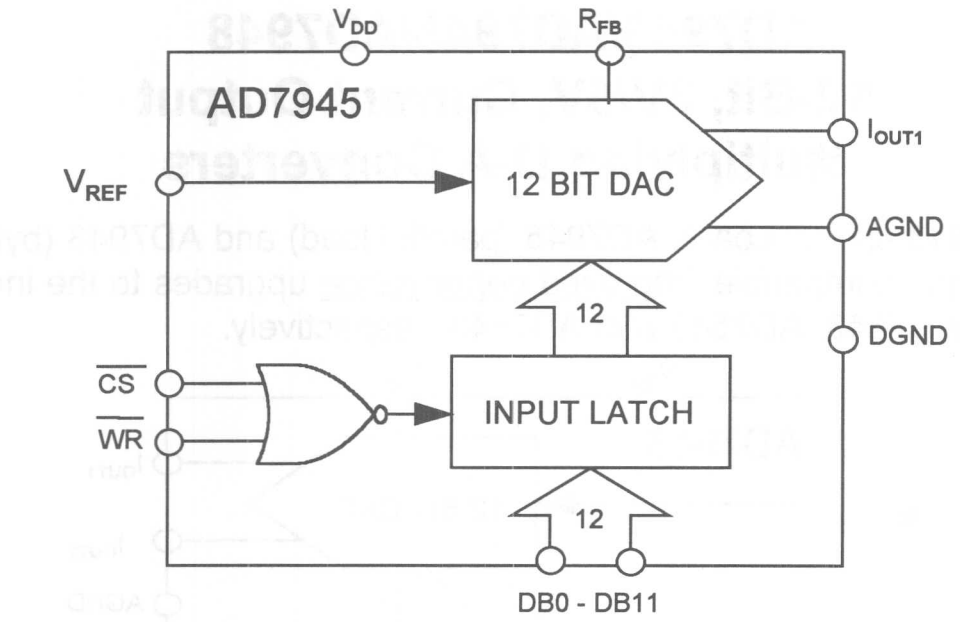
AD7943/AD7945/AD7948
12-Bit, 3V/5V, Current Output Multiplying D-A Converters

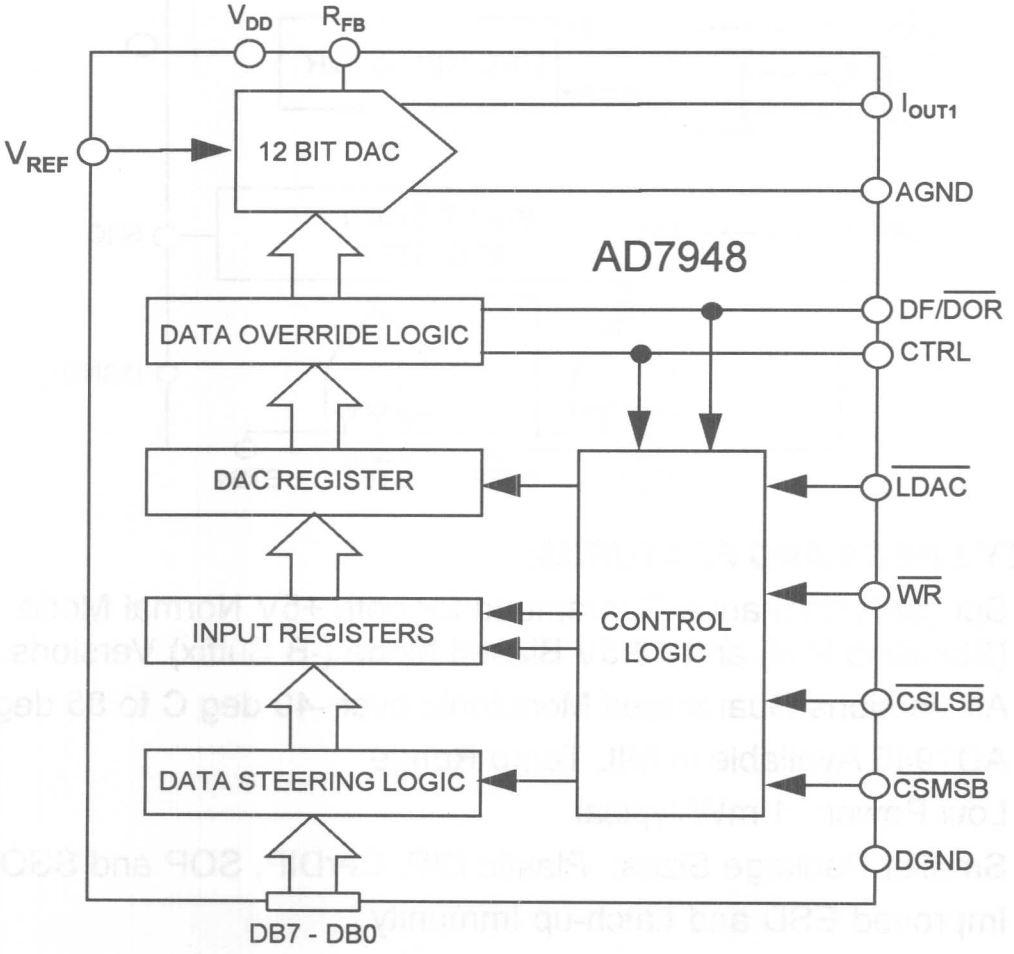
The AD7943 (Serial Load), AD7945 (parallel load) and AD7948 (byte load) are pin-compatible, improved performance upgrades to the industry standard AD7543, AD7545 and AD7548, respectively.

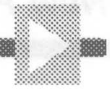


KEY SPECS AND FEATURES:

- Specs/Performance Guaranteed for both +5V Normal Mode (Standard P/N) and +3.3V Biased Mode (-B Suffix) Versions.
- All Versions Guaranteed Monotonic over -40 deg C to 85 deg C
- AD7945 Available in MIL Temp Range
- Low Power: 1 mW typical
- Smaller Package Sizes: Plastic DIP, CerDIP, SOP and SSOP
- Improved ESD and Latch-up Immunity

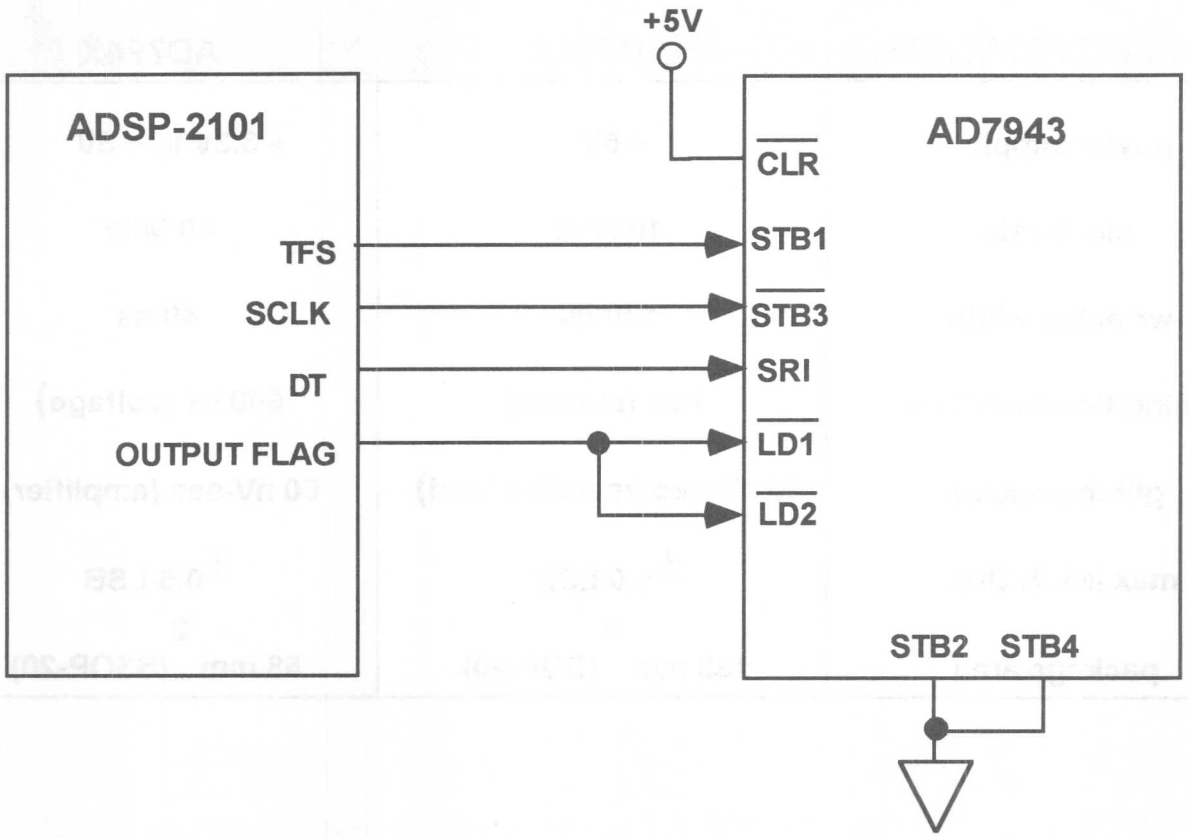

V_{DD}
R_{FB}
AD7945
I_{OUT1}
V_{REF}
12 BIT DAC
AGND
12
DGND
$\overline{CS}$
$\overline{WR}$
INPUT LATCH
12
DB0 - DB11


V_{DD}
R_{FB}
I_{OUT1}
V_{REF}
12 BIT DAC
AGND
AD7948
DATA OVERRIDE LOGIC
DF/$\overline{DOR}$
CTRL
DAC REGISTER
$\overline{LDAC}$
$\overline{WR}$
INPUT REGISTERS
CONTROL LOGIC
$\overline{CSLSB}$
DATA STEERING LOGIC
$\overline{CSMSB}$
DGND
DB7 - DB0

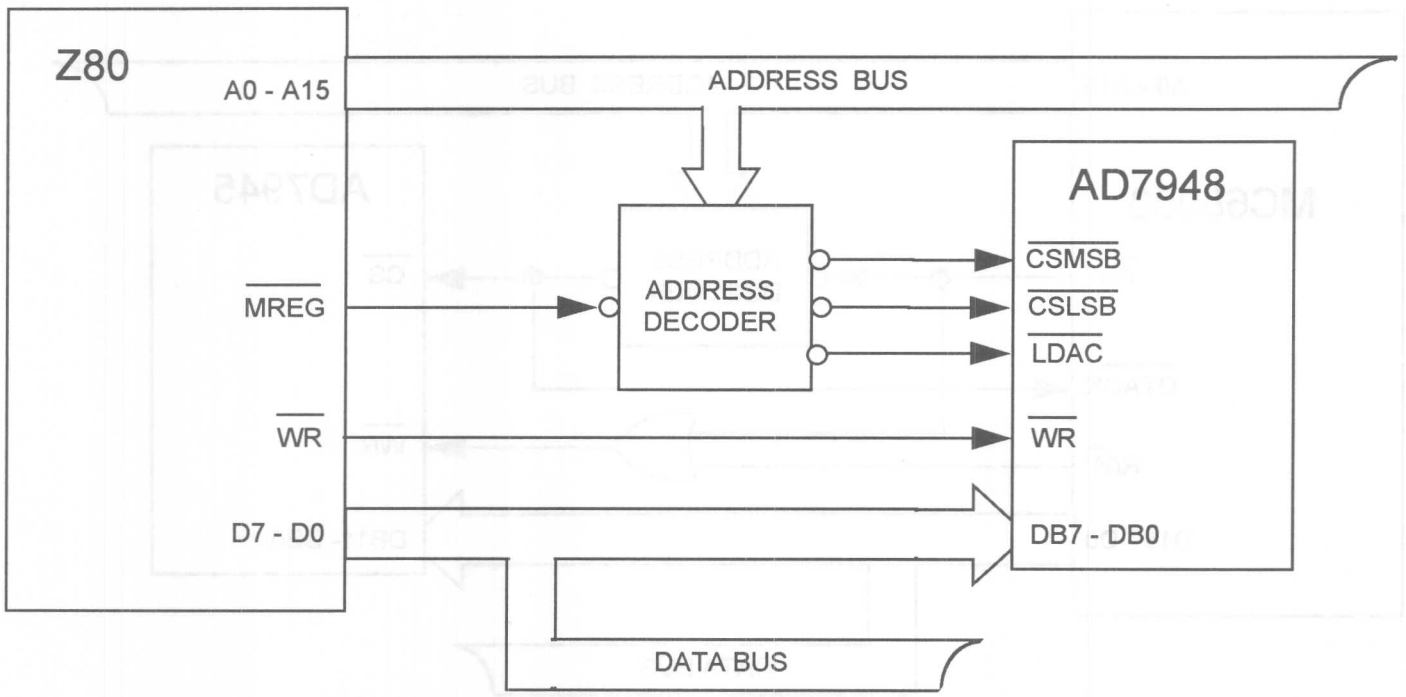


SPECIFICATION	AD754X	AD794X
power supplies	+ 5V	+ 3.3V to + 5V
clock rate	10 MHz	40 MHz
wr pulse width	130 ns	40 ns
settling time to 0.01 %	1 us (current)	600 ns (voltage)
glitch impulse	20 nV-sec (resistive load)	60 nV-sec (amplifier)
max INL & DNL	$\pm$1.0 LSB	$\pm$0.5 LSB
package area	138 mm^2 (SOP-20)	58 mm^2 (SSOP-20)

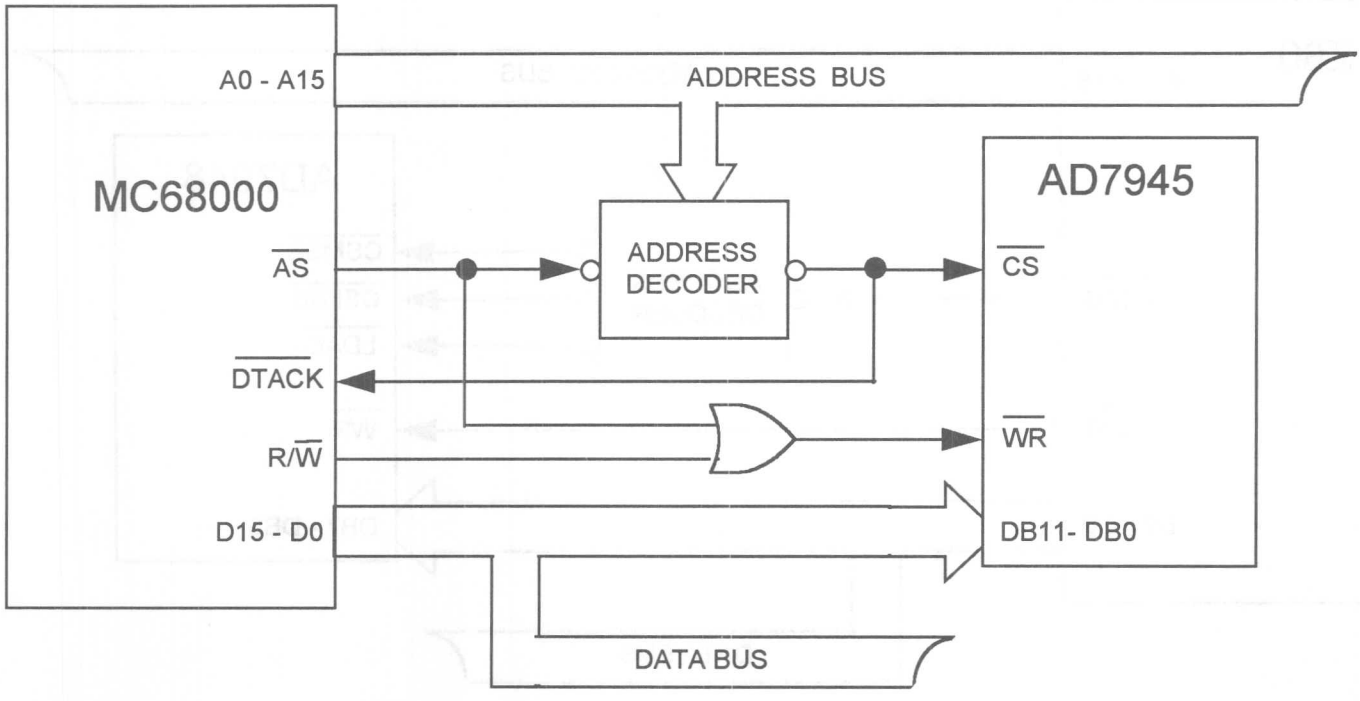
Key Differences Between AD754X and AD794X



AD7943 to ADSP-2101 Serial Interface



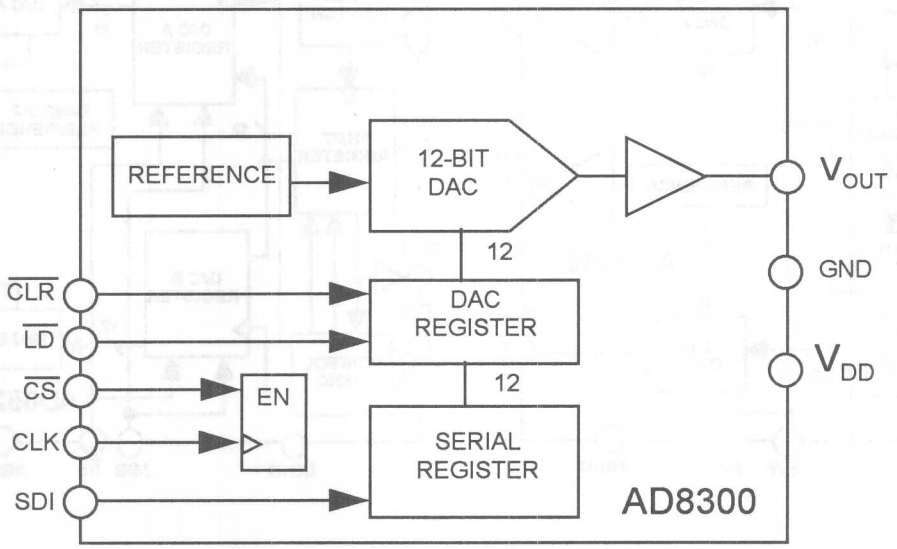
AD7948 to Z80 8-Bit Byte Interface



AD7945 to MC68000 Parallel Interface

AD8300*
12-Bit, 3V Complete Serial D-A Converter

The AD8300 is the industry's first complete, single supply 12-bit DAC that operates from a +3V power supply. The AD8300 is offered in a low profile, 8-pin SOIC package aimed at PCMCIA card applications.

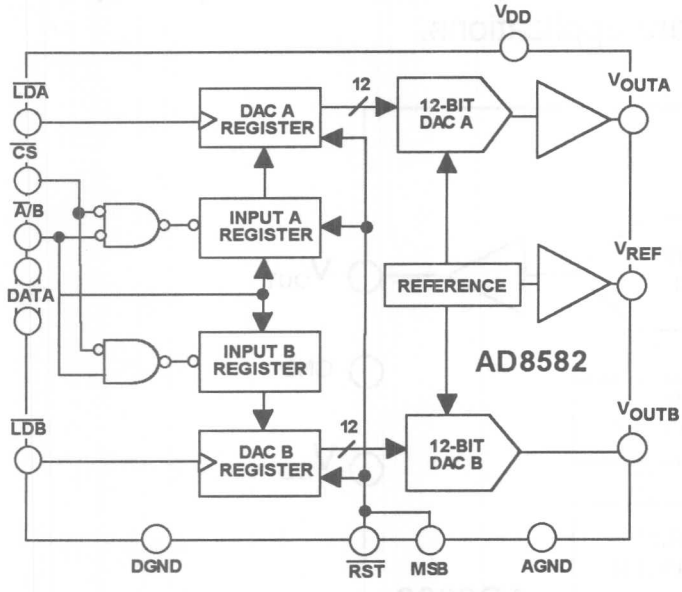


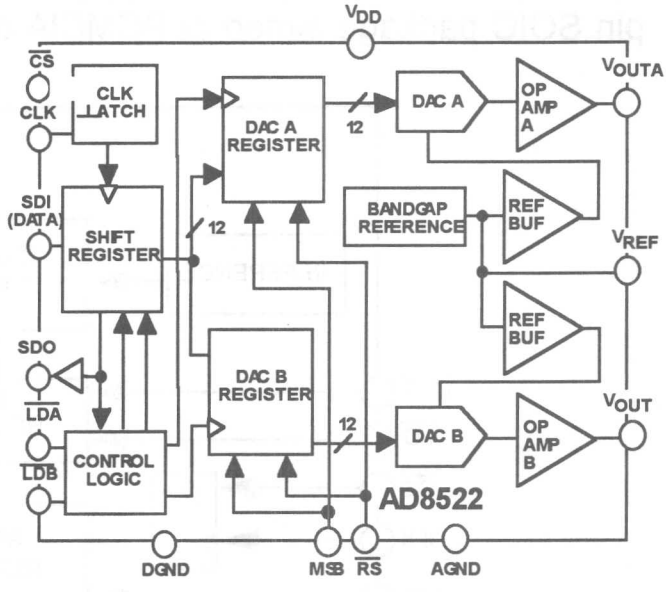
KEY SPECS AND FEATURES:

- Operation Guaranteed From +2.7V to +5.5V DC
- Power Dissipation Typically 1.5 mW @ V_{DD} = 3V
- True Voltage Output:
  - 0V to +2.0475V Full Scale
  - 0.5 mV/Bit Resolution
  - 5mA Output Drive
- High Speed, Double-Buffered 3-Wire Serial Interface : 40 ns
- CLR Function Sets Output to Zero Scale at Power Up or via User Command
- 8-Pin Plastic DIP or Low Profile (1.5 mm) SOIC Package

**Preliminary Technical Information*

AD8522/AD8582
12-Bit, Dual, 5V Complete Serial/Parallel D-A Converters



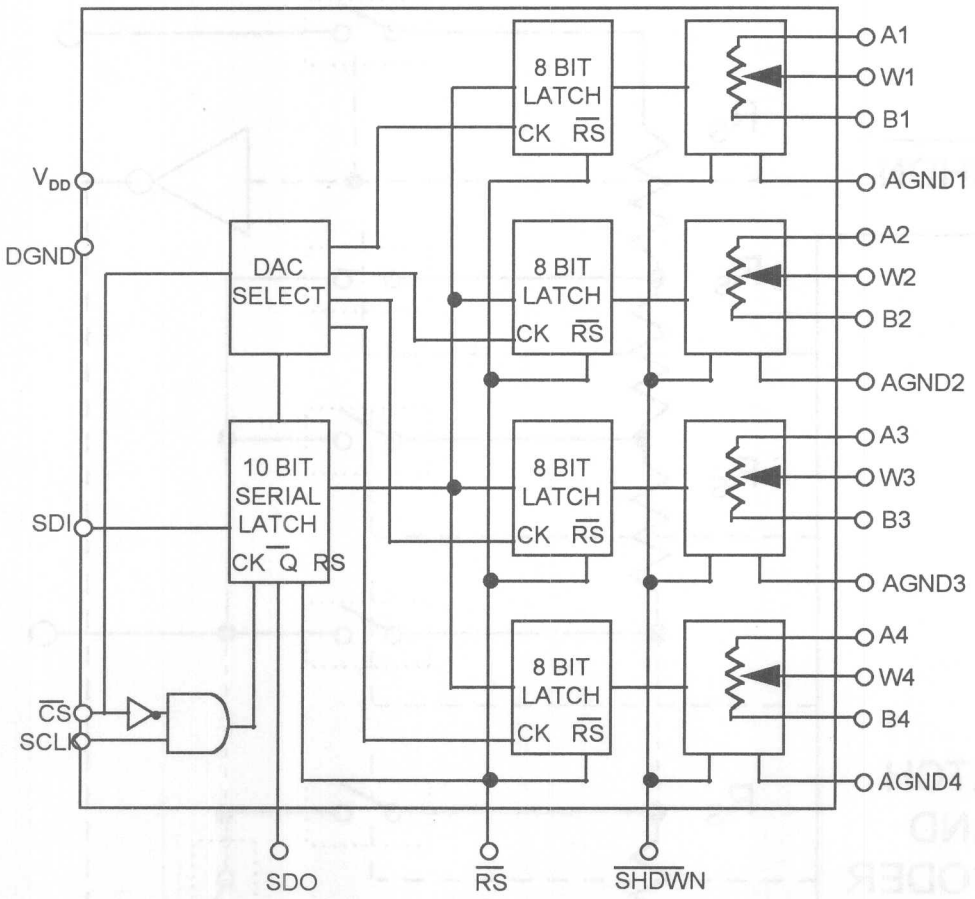


KEY SPECS AND FEATURES:

- Complete, Dual, 12-Bit Voltage Output D-A Converters: No External Components
- Serial (AD8522) or Parallel (AD8582) Digital Inputs
- Guaranteed Monotonic over Temperature
- 4.095V Full Scale Output Range (1 mV/LSB)
- RST Pin Sets DAC Outputs to Zero or Mid-Scale
- Double-Buffered Latches
- Single Supply, Low Power Operation: 5 mW @ + 5V Supply
- Space-Saving Packages:
  - AD8522: 14-Pin Plastic DIP and Low Profile (1.5 mm) SO-14
  - AD8582: 24-Pin Plastic DIP and SOIC

AD8402/AD8403
8-Bit, Dual/Quad Digital Potentiometers

The AD8402 and AD8403 are true, 3-terminal, electronic potentiometers with digital control of resistance in 256 discrete steps.



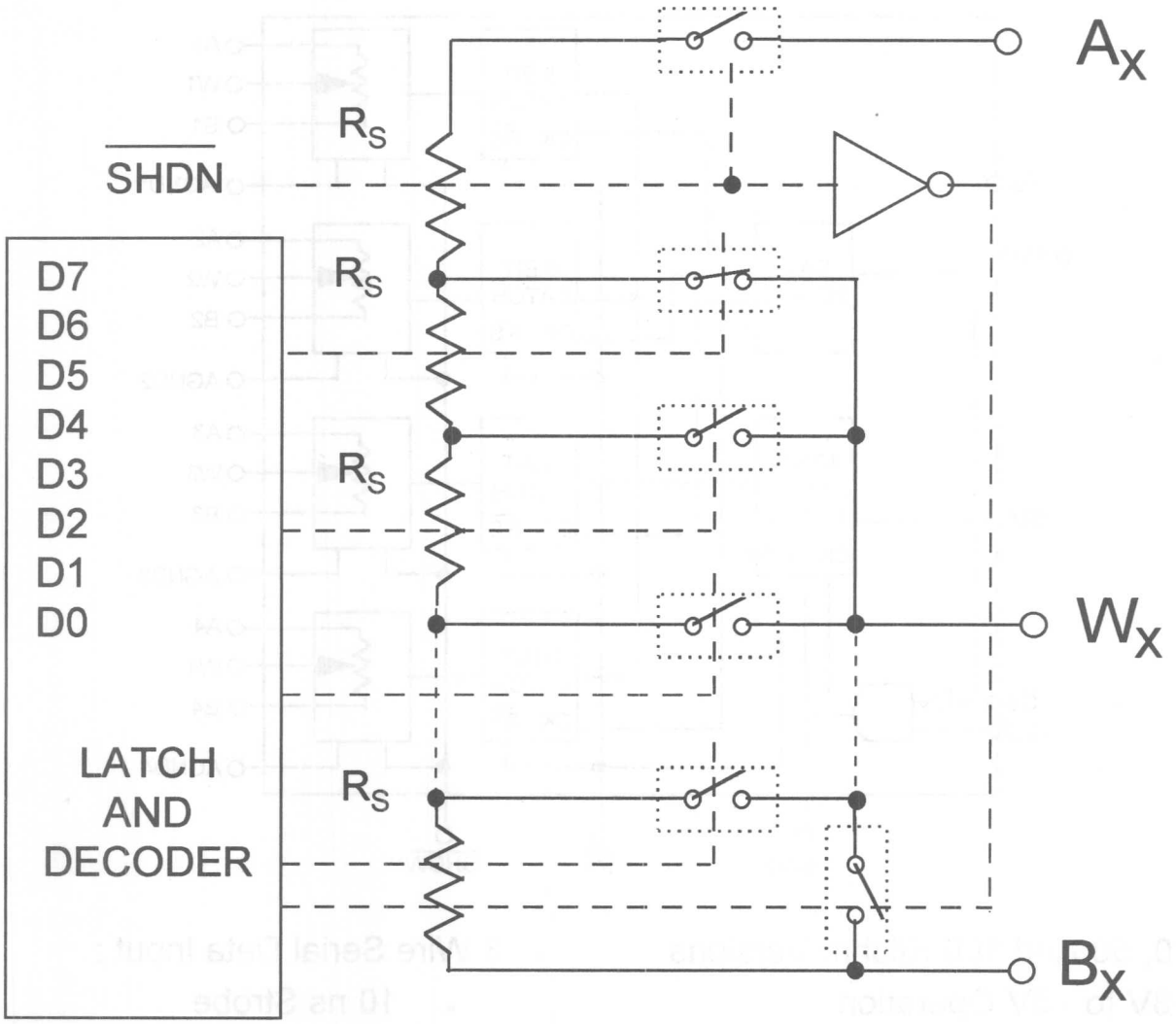
- 10, 50 And 100 Kilohm Versions
- +3V to +5V Operation
- 0V to +V_{DD} Range on A, B and W
- Resistor Noise < 9 nV /Hz
- Reset Mode to Mid Scale
- Shutdown Mode : < 1 uA
- 3 Wire Serial Data Input :
  - 10 ns Strobe
- AD8402 : 14 Pin DIP and SOIC
- AD8403 : 24 Pin SOIC
- -40 deg C to +85 deg C Operation

$R_{WB} = (D_X)/256 \times R_{BA} + R_W$

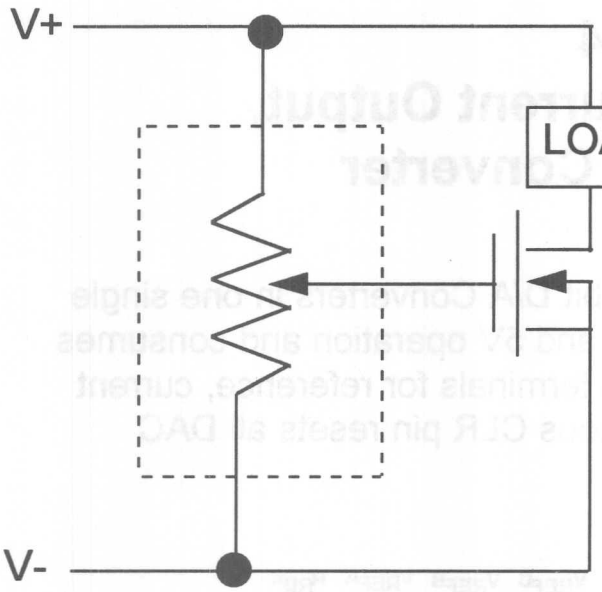
D_X = Digital Code

R_{BA} = Resistance from B to A

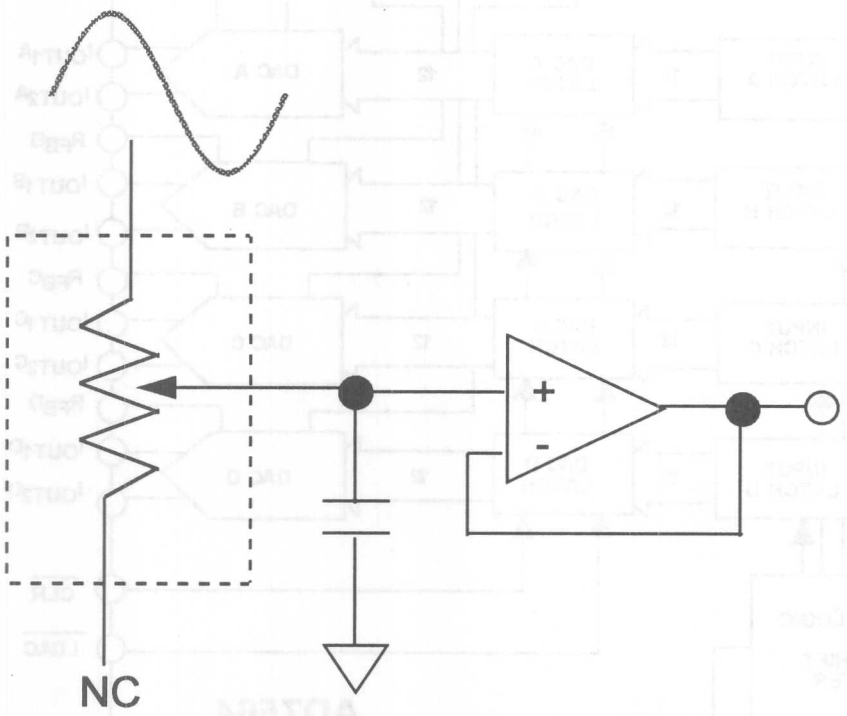
R_W = Wiper Resistance, typ 200 Ω



Equivalent digital potentiometer circuit. Power shutdown opens AX switch. Latch contents unchanged.



3 Terminal,
Voltage Divider Mode

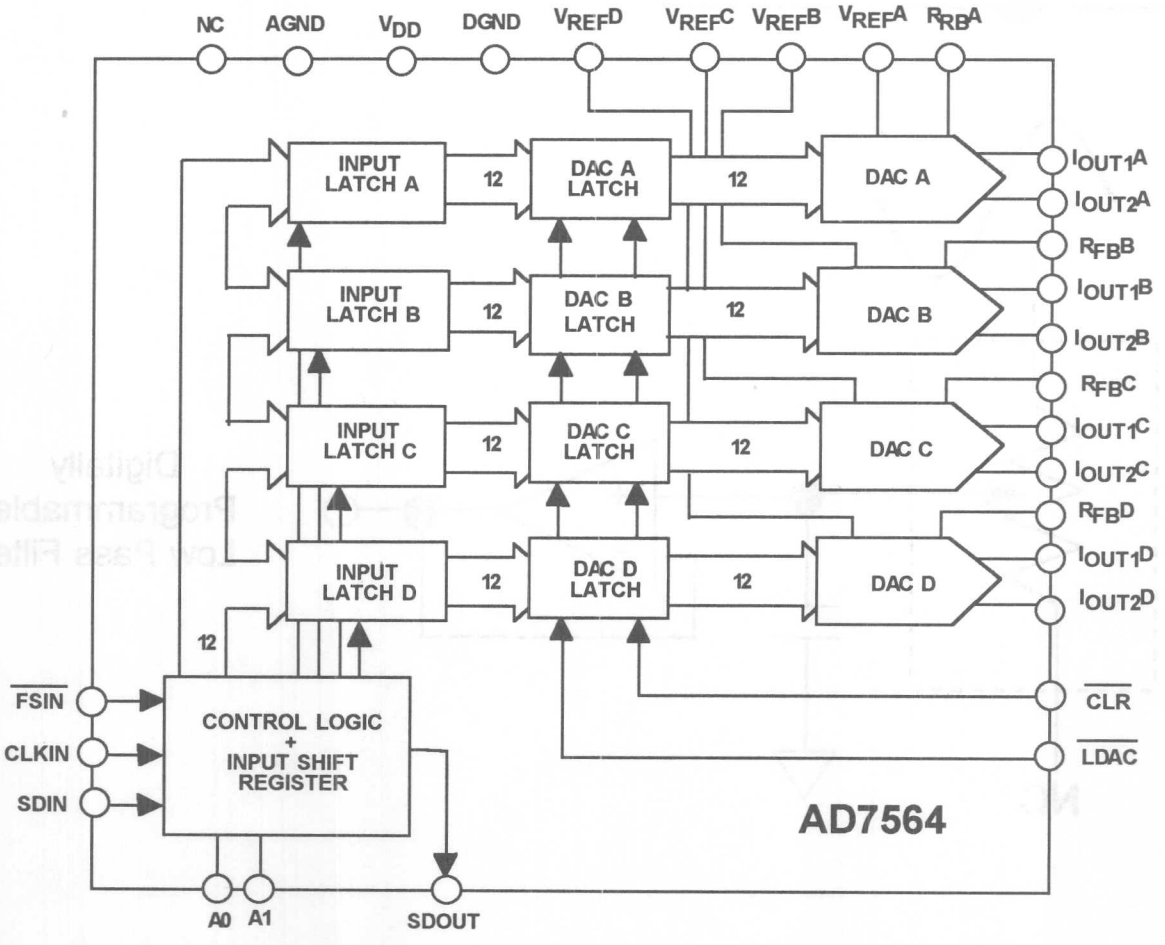


Digitally
Programmable
Low Pass Filter

Typical Applications for the AD8402 and AD8403

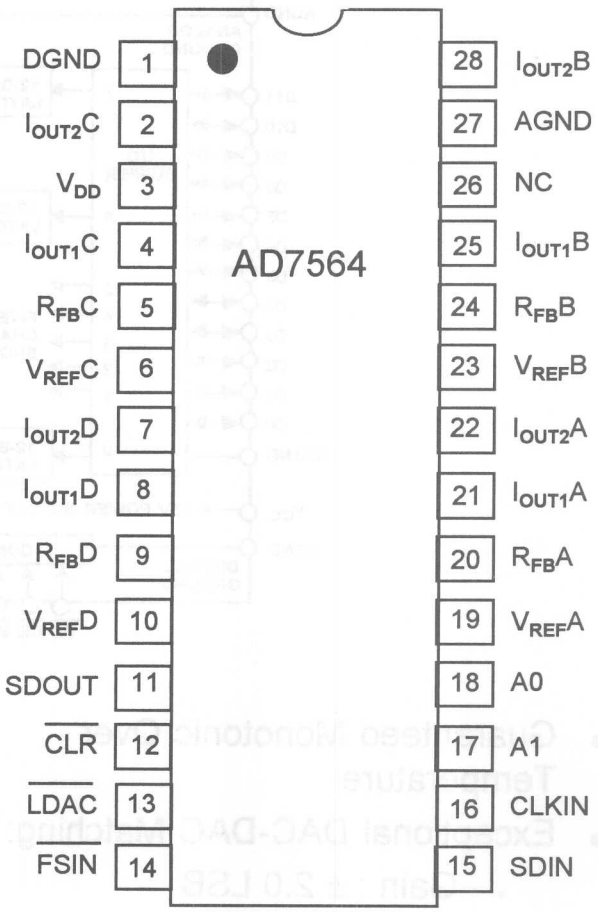
AD7564
12-Bit, Quad, 3V, Current Output, Multiplying D-A Converter

The AD7564 provides four independent, 12-bit D/A Converters in one single package. The AD7564 is specified for 3.3V and 5V operation and consumes only 10 uA. Each DAC has its own separate terminals for reference, current output and feedback resistor. An asynchronous CLR pin resets all DAC latches to all 000's.



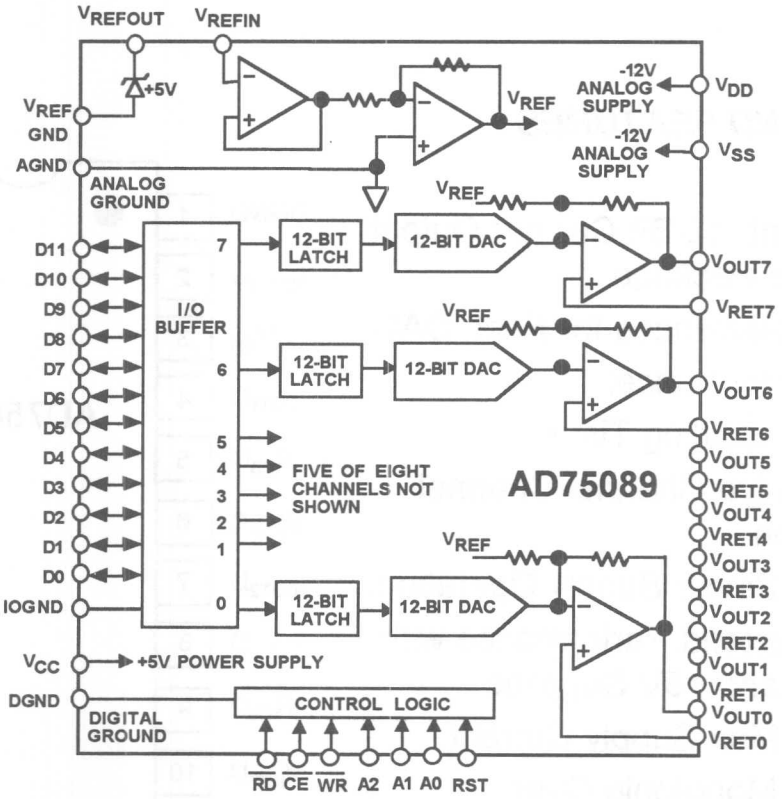
KEY SPECS AND FEATURES :

- 4 Independent, 12-Bit Current Output DACs in One Package
- Sepaprate References for Each DAC
- Dynamic Performance:
  - » 550 ns Settling Time
  - » -76 dB typ Channel-Channel Isolation
- Low Power, Single Supply Operation:
  - » Guaranteed Performance with +3.3V and +5V Supplies
  - » 10 uA Max Supply Current
- Guaranteed Monotonic Over Temperature
- 4-Quadrant Multiplication
- Simultaneous Update and Reset Capability
- -40 deg C to +85 deg C Operation



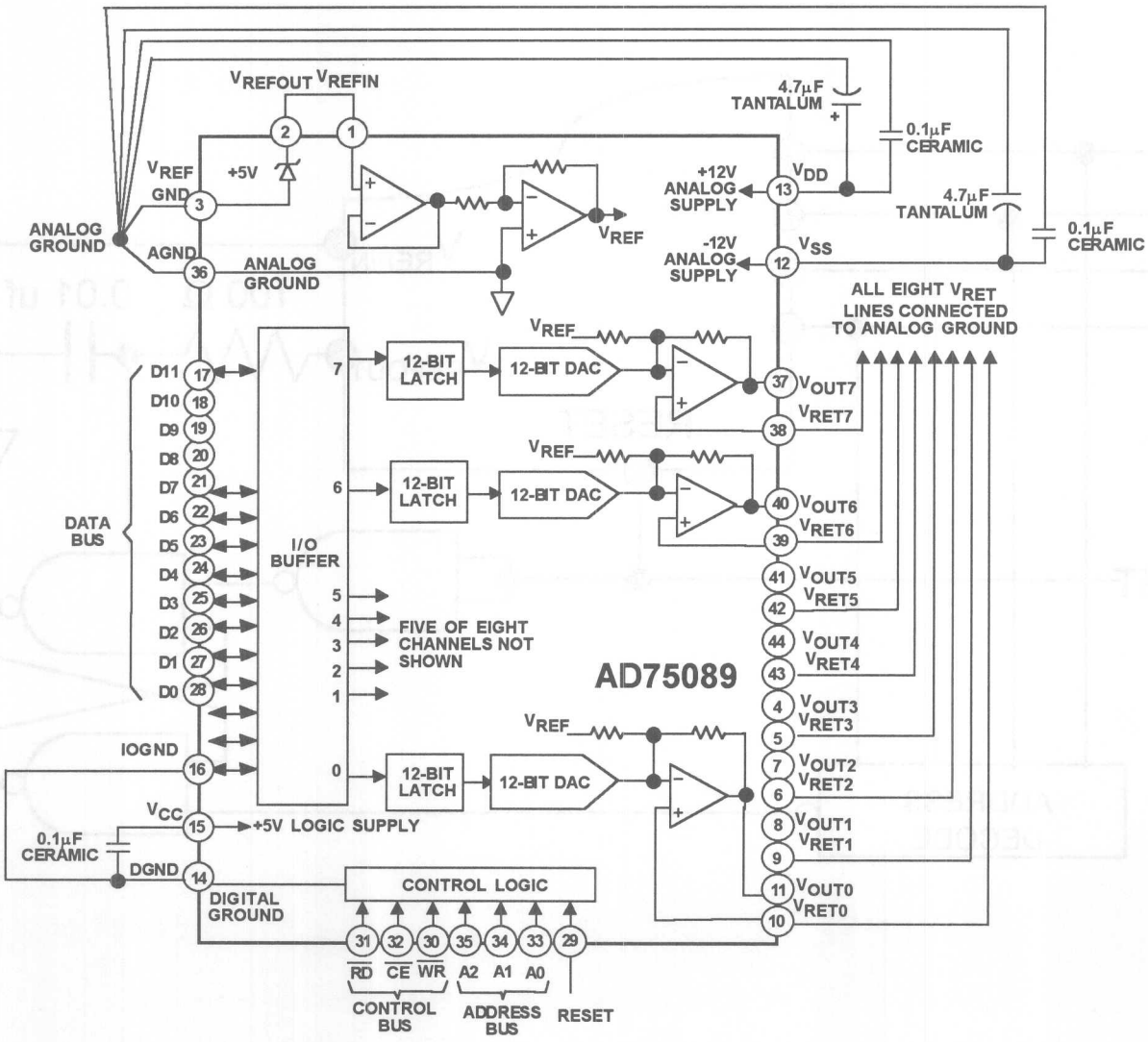
28-Pin Plastic DIP,SOIC
and
SSOP Packages

AD75089
Octal, 12-Bit, Voltage Output DACPORT®

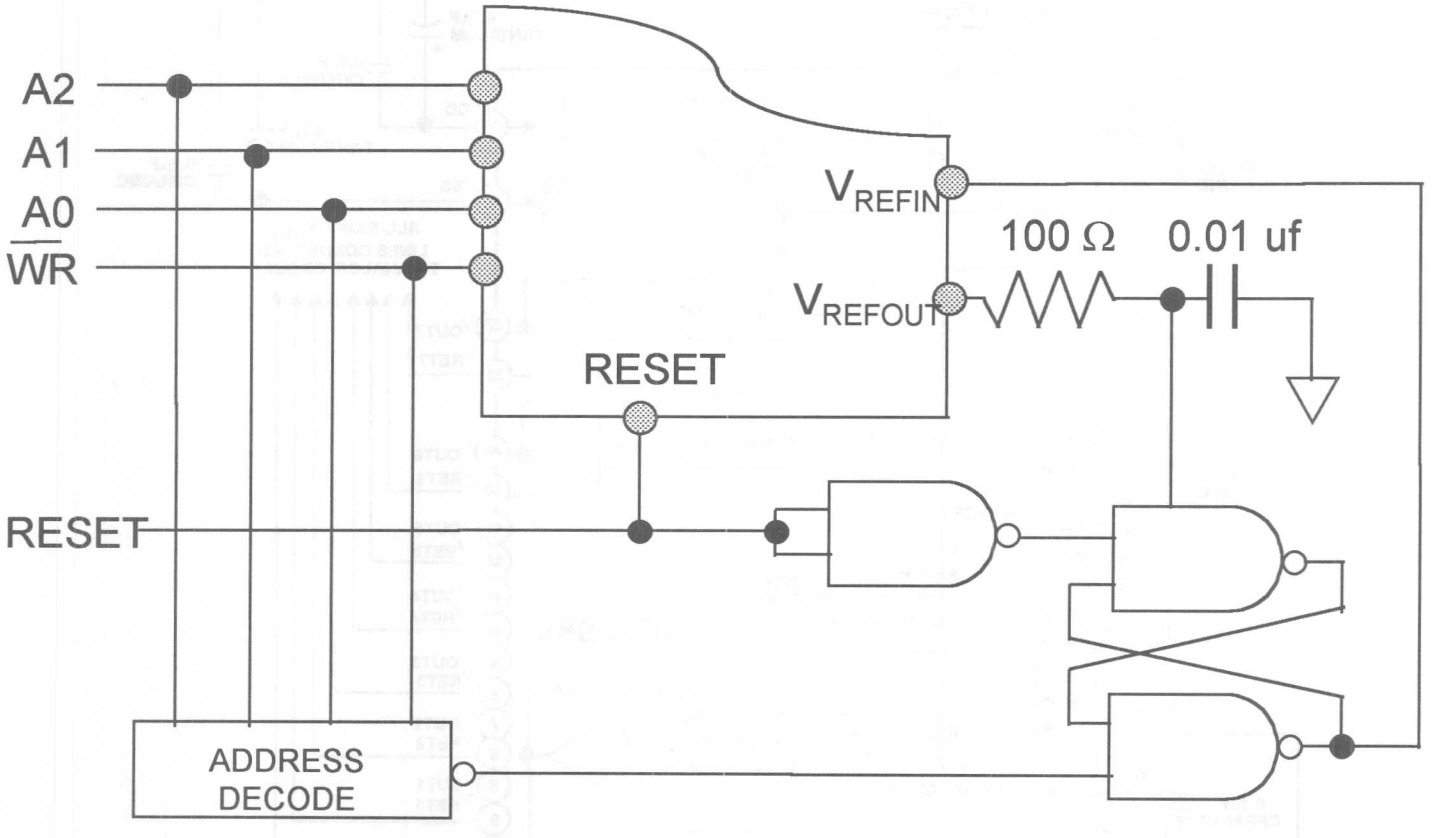


- Guaranteed Monotonic Over Temperature
- Exceptional DAC-DAC Matching:
  - Gain : ± 2.0 LSB
  - Offset : ± 2.5 LSB
- Digital Crosstalk > -60 dB
- Voltage Output: ± 5 Volts @ 2 mA
  - Drives up to 500 pF loads
  - Settling Time < 10 µs
- Internal + 5V or External Reference
- 12-Bit Parallel Port with Readback Feature
- Simultaneous Asynchronous RESET of all DAC Latches to Minus Full Scale
- Power Supplies: ± 12 Volts, + 5 Volts, Only 30 mW per DAC

DACPORT is a registered trademark of Analog Devices, Inc.



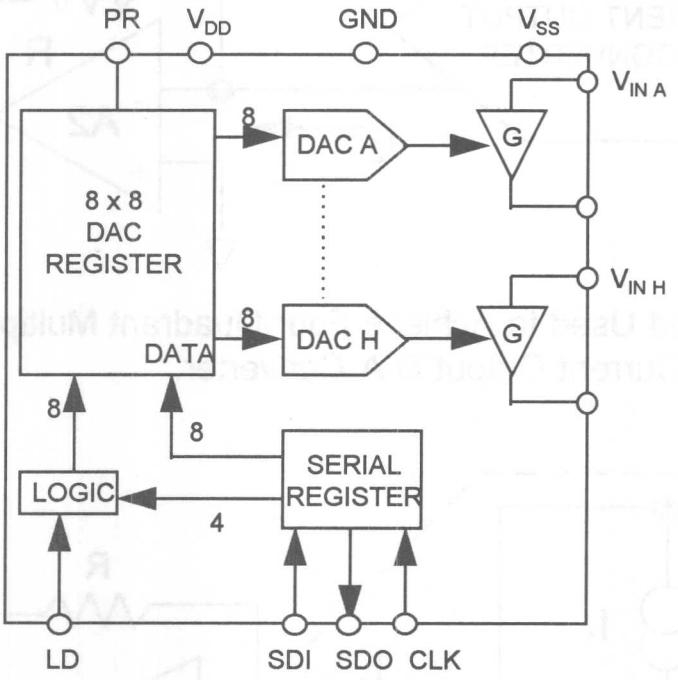
Recommended Circuit Schematic



Circuitry to Reset All AD75089 DAC Outputs to Zero Volts

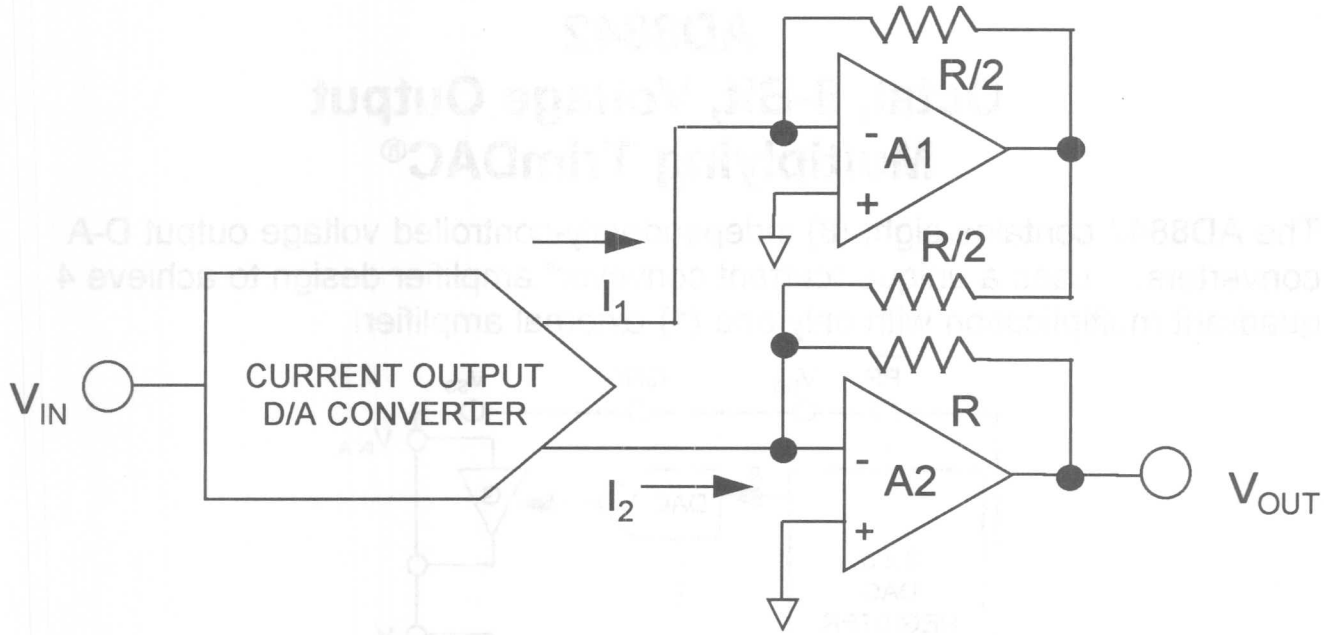
AD8842
Octal, 8-Bit, Voltage Output Multiplying TrimDAC®

The AD8842 contains eight (8) independently-controlled voltage output D-A converters. It uses a unique "current conveyor" amplifier design to achieve 4 quadrant multiplication with only one (1) external amplifier!

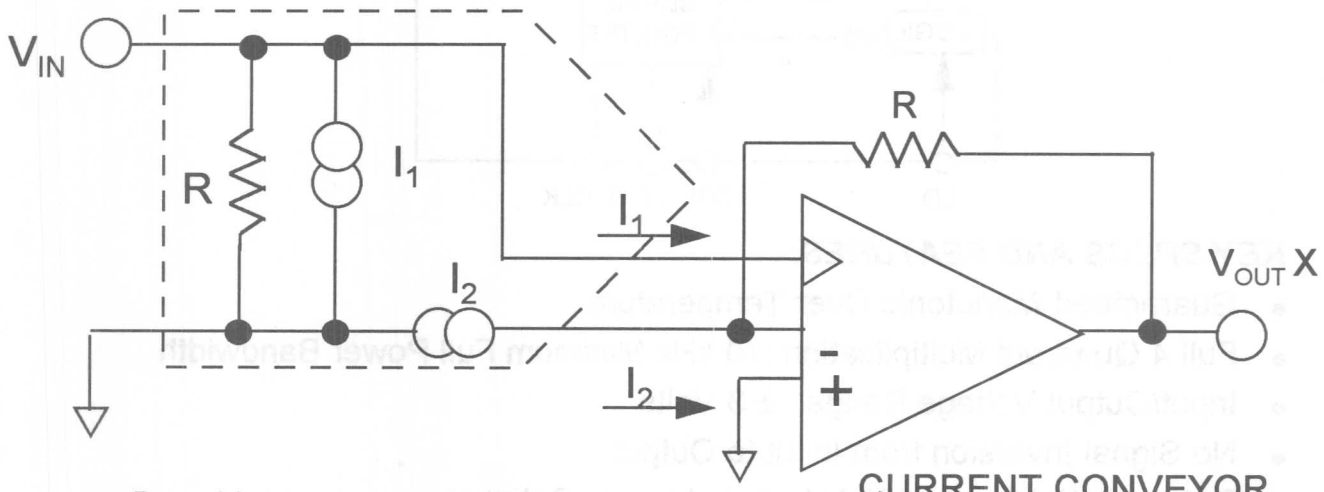


KEY SPECS AND FEATURES:

- Guaranteed Monotonic Over Temperature
- Full 4 Quadrant Multiplication :10 kHz Minimum Full Power Bandwidth
- Input/Output Voltage Range: ± 3 Volts
- No Signal Inversion from Input to Output
- 3-Wire Serial Input: 500 kHz Data Update Rate
- PR Pin resets all DACs to mid scale (zero volts)
- Low Power Operation: 80 mW for ± 5 Volts
- Use DAC8841 for Single +5 Volt Applications
- Pin Compatible with DAC8840 : 1 MHz Multiplying Bandwidth
- 24-Pin Plastic DIP and SOIC Packages



Traditional Method Used to Achieve Four-Quadrant Multiplication With a Complementary Current Output D-A Converter.

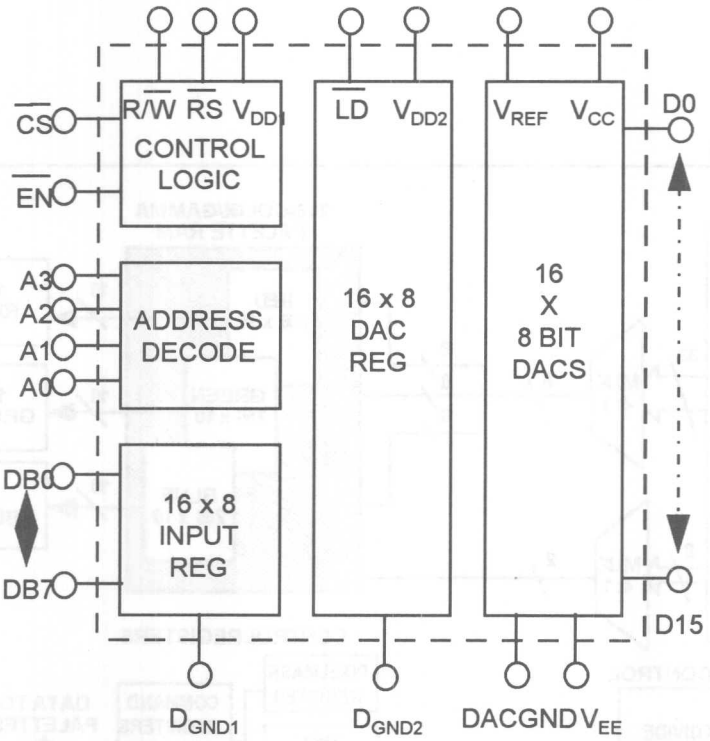


$$I_1 = \frac{D}{256} \times \frac{V_{REF}}{R} \qquad I_2 = \frac{(1\text{-}D)}{256} \times \frac{V_{REF}}{R}$$

A New "Current Conveyor" Amplifier Design Used in the AD8842 Emulates the Two Amplifier Solution Shown Above to Achieve Four-Quadrant Multiplication With Only One Amplifier.

AD8600
16 Channel, 8-Bit, Multiplying D-A Converter

The AD8600 is a cost-effective solution to high board density requirements. Each AD8600 contains 16 independent, voltage output D-A converters that share a common reference in a space-saving, 44-Pin PLCC package.

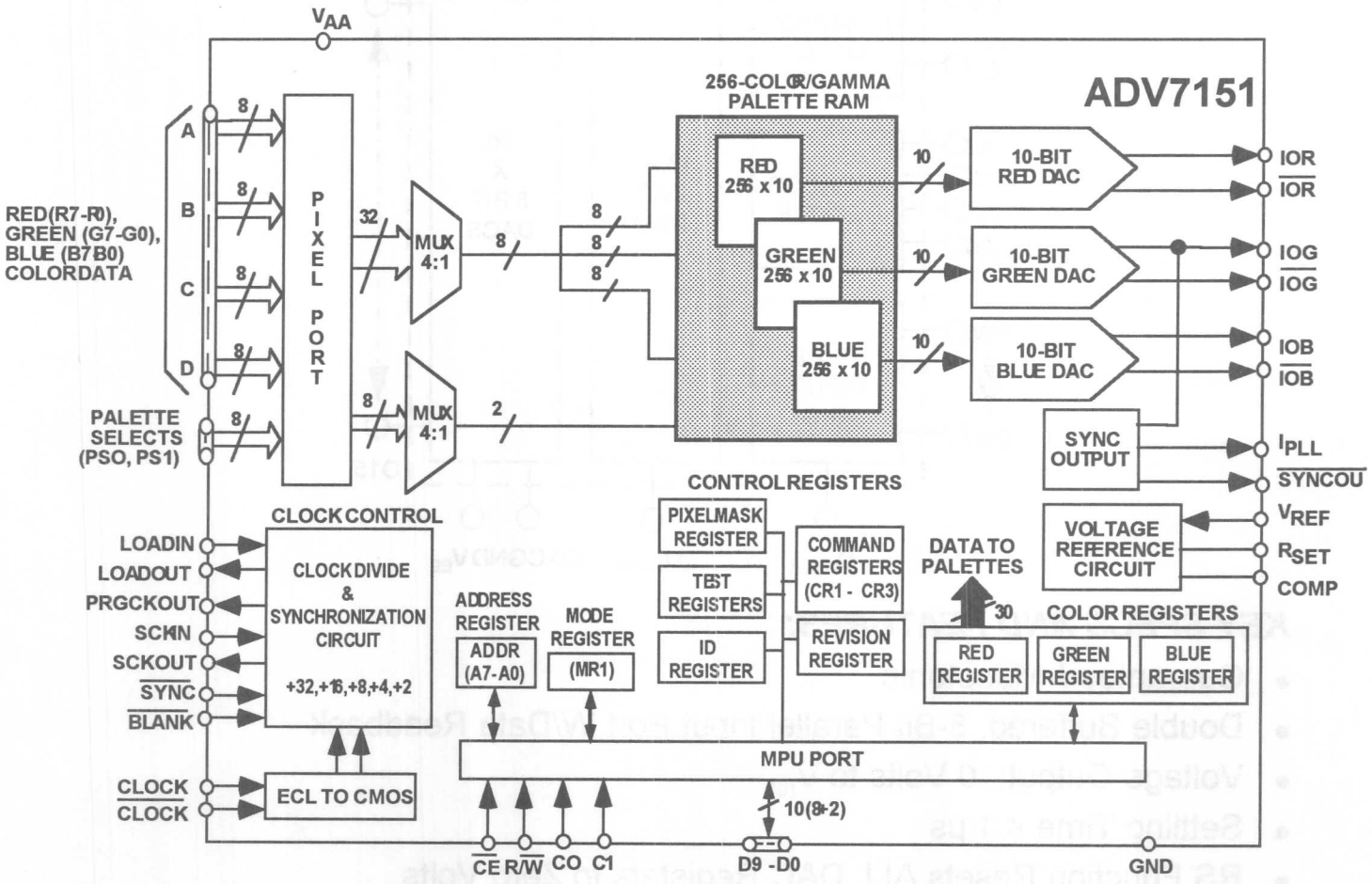


KEY SPECS AND FEATURES:

- Guaranteed Monotonic
- Double Buffered, 8-Bit Parallel Input Port W/Data Readback
- Voltage Output: 0 Volts to V_{ref}
- Settling Time < 1 µs
- RS Function Resets ALL DAC Registers to Zero Volts
- 500 kHz Reference Bandwidth
- Single (+ 5V) or Dual (± 5V) Supply Operation, Only 10 mW per DAC
- 44-Pin PLCC Packages

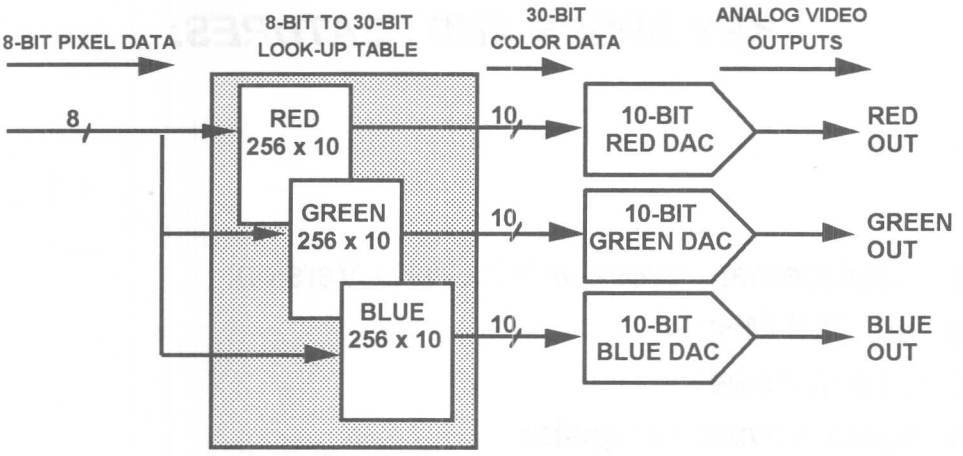
ADV7151
220 MHz, Pseudo Color Graphics, Triple 10-Bit Video RAM-DAC

The ADV7151L is the Industry's fastest + 5V CMOS, 10-Bit Pseudo-Color Graphics Video RAM-DAC.

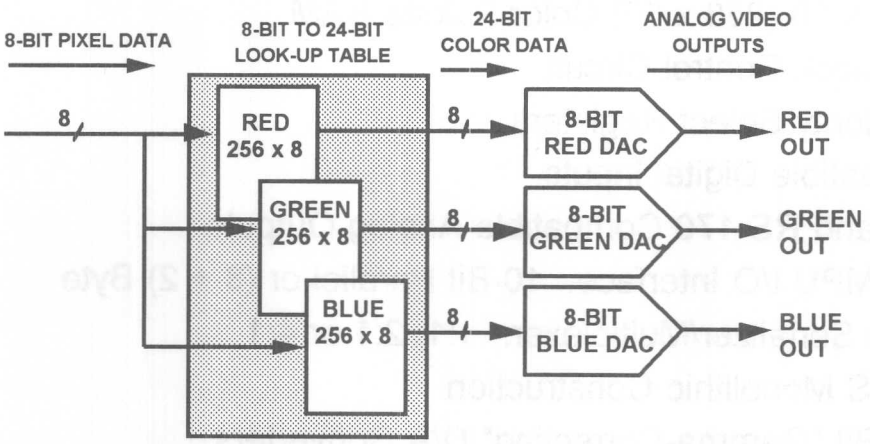


KEY SPECS AND FEATURES:

- Improved Replacement over our "K" Grade Version:
  - Faster: 220 MHz
  - 50 % Less Power
  - On-Board Revision Register
  - Auto-Calibration Clock Circuit
  - Lower Cost
  - Thermally-Enhanced 100 Pin PQFP Package Achieves θ_{jc} < 1.0° C / watt
- 10-Bit (30-Bit Gamma-Corrected) Pseudo-Color Operation @ 220, 170, 135, 110 or 85 MHz Update Rates
- Triple 256 x 10 (256 x 30) Color Palette RAM
- On-Chip Clock Control Circuit
- Palette Priority Select Registers
- TTL Compatible Digital Inputs
- RS-342A and RS-170 Compatible Analog Outputs
- Standard MPU I/O Interface: 10-Bit Parallel or (8 + 2) Byte
- Pixel Data Serializer/Multiplexer: 1:1, 2:1 or 4:1
- +5V CMOS Monolithic Construction
- Triple 10-Bit "Gamma-Correcting" D/A Converters



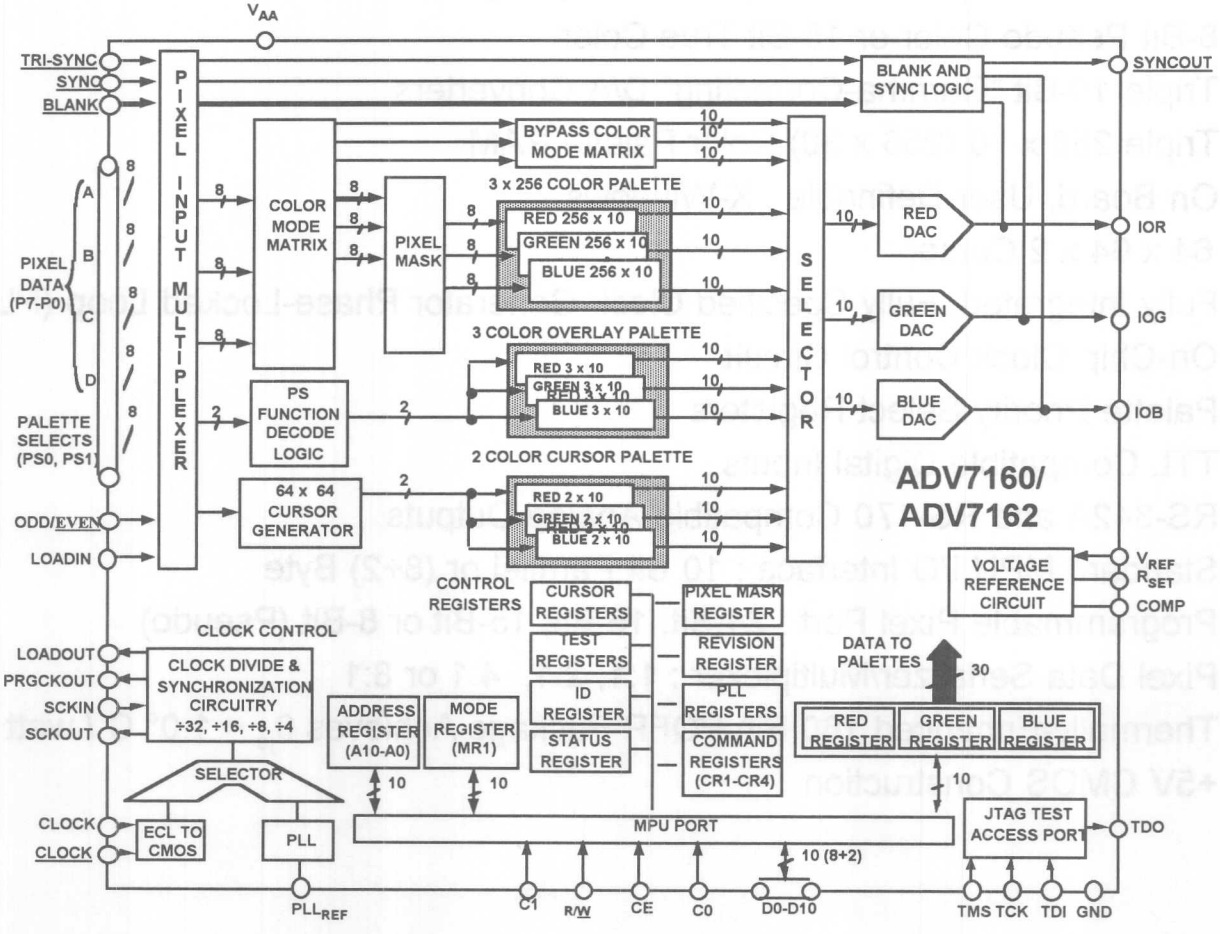
8-Bit to 30-Bit Pseudo-Color Configuration



8-Bit to 24-Bit Pseudo-Color Configuration

ADV7160/ADV7162
220/170 MHz, True Color Graphics, Triple 10-Bit Video RAM-DAC

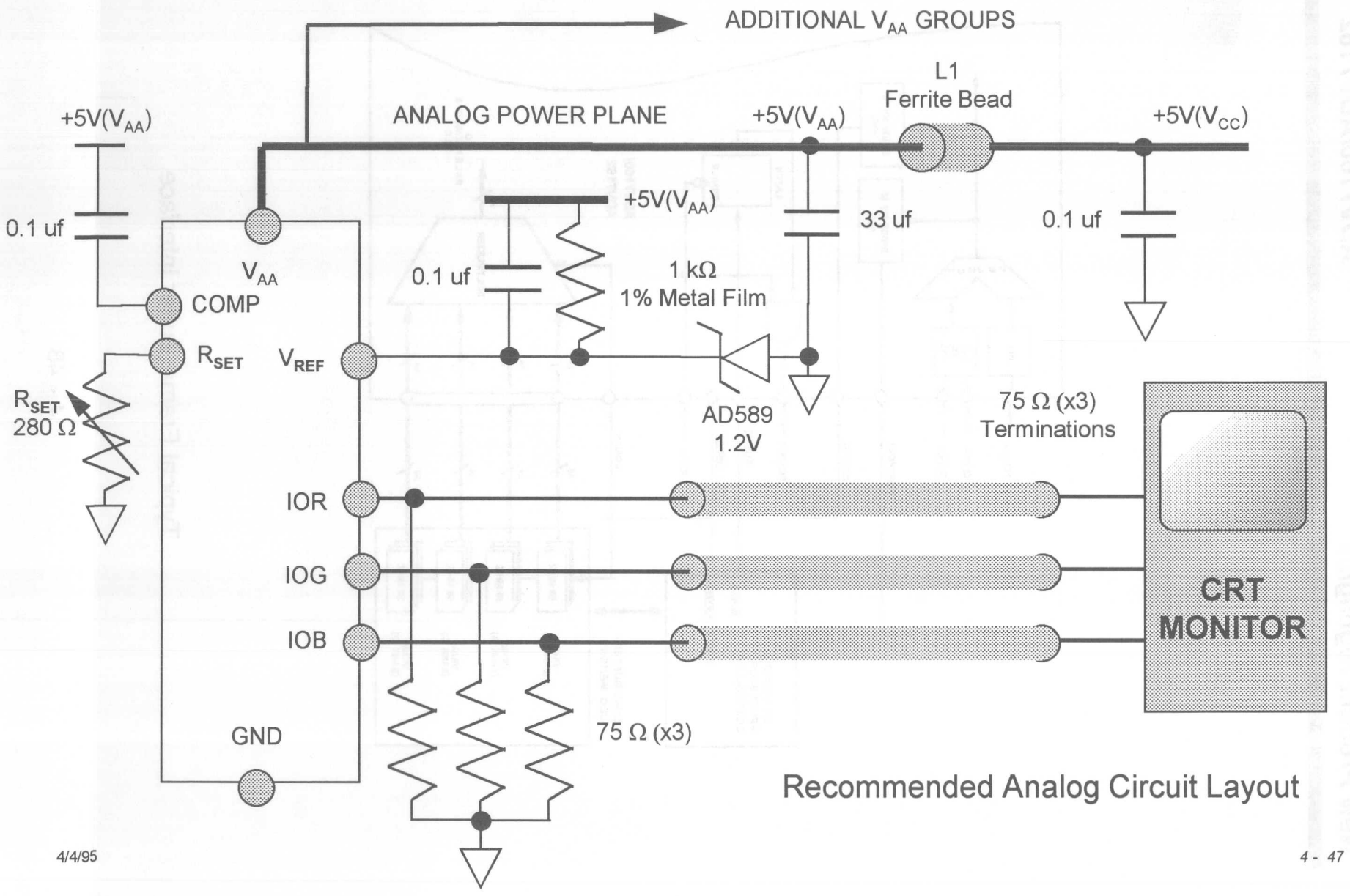
The ADV7160 and ADV7162 are *enhanced* performance upgrades to our ADV7150L and ADV7152L, respectively.



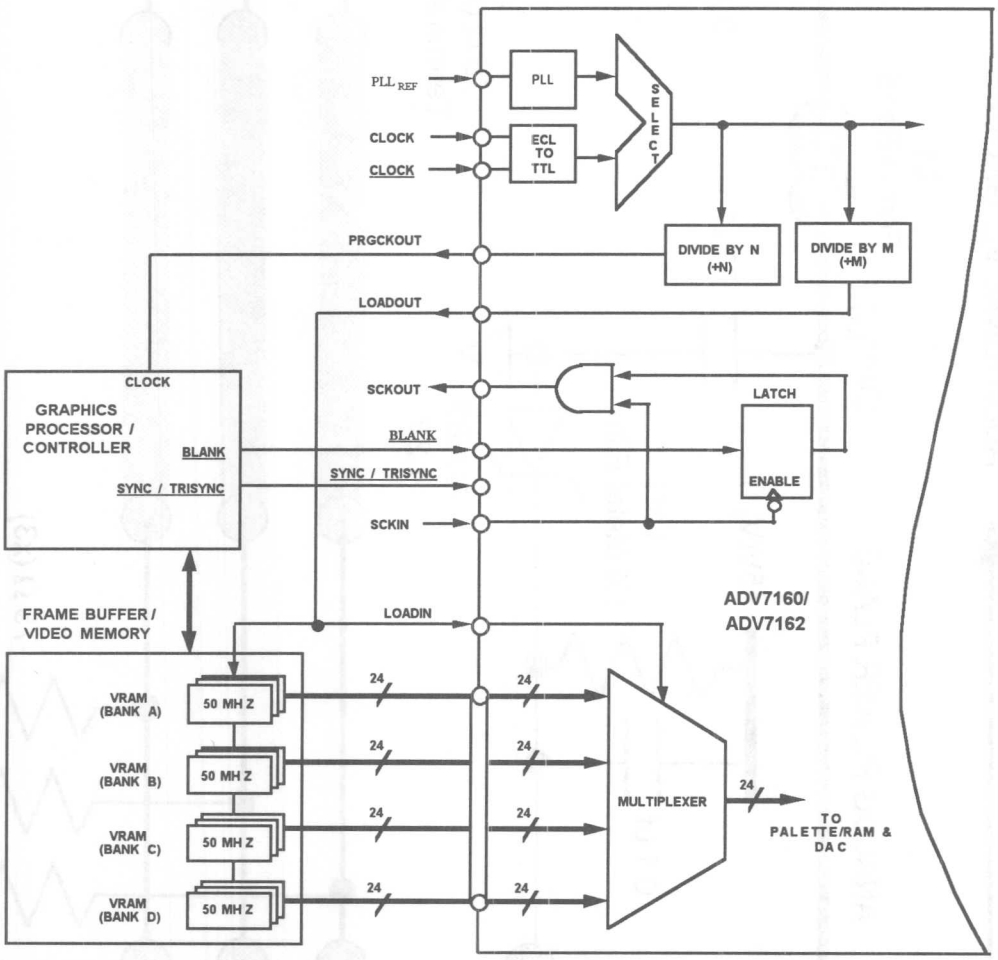
**Preliminary Technical Information*

KEY SPECS AND FEATURES:

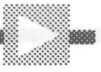
- 24-Bit (30-Bit Gamma Corrected) True Color Operation with 220*, 170, 135, or 110* MHz Update Rates (*ADV7160, only)
- 8-Bit Pseudo-Color or 15-Bit True Color
- Triple 10-Bit "Gamma-Correcting" D/A Converters
- Triple 256 x 10 (256 x 30) Color Palette RAM
- On Board, User-Definable , X-Windows , 64 x 64 x 2 Cursor
- Fully Integrated, Fully Specified Clock Generator Phase-Locked Loop (PLL)
- On-Chip Clock Control Circuit
- Palette Priority Select Registers
- TTL Compatible Digital Inputs
- RS-342A and RS-170 Compatible Analog Outputs
- Standard MPU I/O Interface : 10 Bit Parallel or (8+2) Byte
- Programmable Pixel Port : 24-Bit, 16-Bit, 15-Bit or 8-Bit (Pseudo)
- Pixel Data Serializer/Multiplexer : 1:1, 2:1, 4:1 or 8:1
- Thermally-Enhanced 160 Pin PQFP Package Achieves θ_{jc} < 1.0° C / watt
- +5V CMOS Construction



Recommended Analog Circuit Layout



Typical Frame Buffer Interface



SECTION 5
DATA CONVERTER SUPPORT COMPONENTS

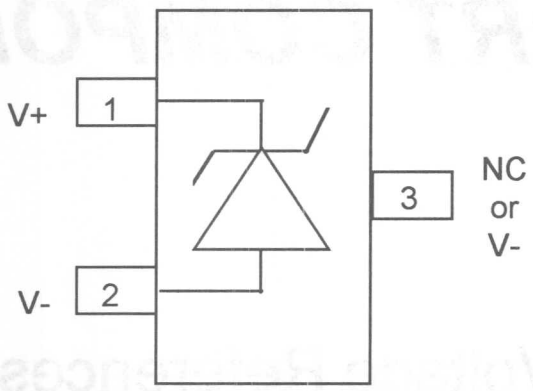
Voltage References

High Performance CMOS Multiplexers

Low Leakage, Low R_{on} CMOS Switches

*AD1580**
1.2V, Micropower, Precision Voltage Reference

The AD1580 is a *low cost,* precision 2 terminal shunt reference offered in a compact, surface-mount SOT-23 package!



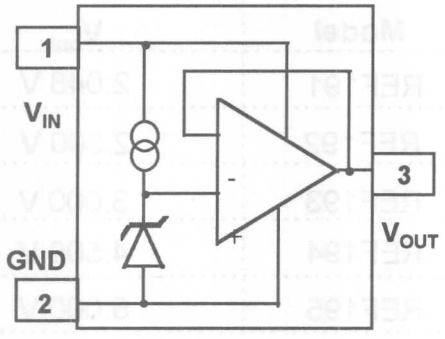
KEY SPECS AND FEATURES:

- High Accuracy: ± 0.1 % max
- Output Voltage Drift: 100 ppm/deg C max
- 50 uA - 10 mA Output Current
- Load Regulation: 10 mV max, 50 uA ≤ I_{in} ≤ 10 mA
- Output Impedance < 1 ohm
- Wideband Noise typ 16 uV rms, 10 Hz - 10 kHz
- -40 deg C to +85 deg C Operating Temperature Range
- Compact, Surface-Mount, SOT-23 Package

**Preliminary Technical Information*

*AD1581-AD1585**
1.2V to 5.0V Micropower, Precision Voltage References

The AD1581 - AD1585 are a family of *low cost*, low power, low dropout, three terminal precision bandgap voltage references in a compact, SOT-23 surface-mount package.



AD1581-1585

Model	V_{out}
AD1581	1.200 V
AD1582	2.500 V
AD1583	3.000 V
AD1584	4.500 V
AD1585	5.000 V

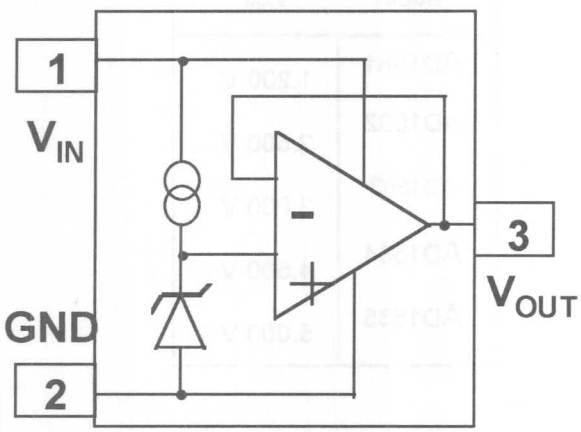
KEY SPECS AND FEATURES:

- High Accuracy: ± 0.8 % max
- Output Voltage Drift: 25 ppm/deg C max
- Wide Operating Range: $V_{in} = V_{out}$ + (200 mV to 12V)
- Sink or Source up to 10 mA Current
- Load Regulation: 10 mV max, 50 uA ≤ I_{in} ≤ 10 mA
- Output Impedance < 1 ohm
- Wideband Noise typ 50 uV rms, 10 Hz - 10 kHz
- -40 deg C to +85 deg C Operating Temperature Range
- Compact, Surface-Mount, SOT-23 Package

** Preliminary Technical Information*

*REF-190 Series**
Precision Micropower, Low Drop-Out Voltage References

The REF-190 series are a family of precision, bandgap voltage references that utilize a patented, temperature drift curvature correction circuit plus laser trimming to achieve very low temperature drift and very high accuracy.

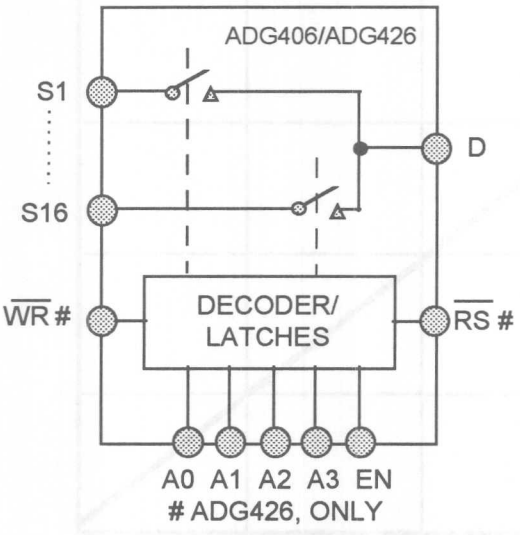


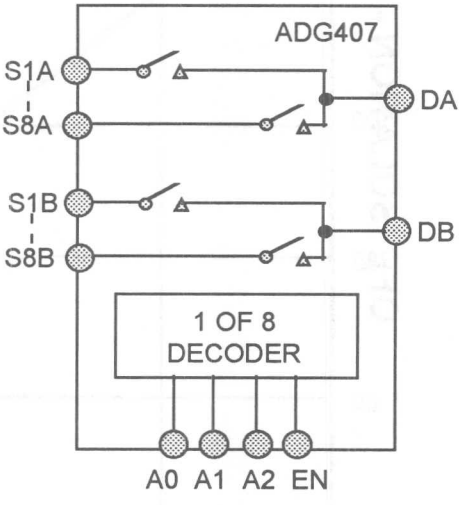
Model	V_{out}
REF191	2.048 V
REF192	2.500 V
REF193	3.000 V
REF194	4.500 V
REF195	5.000 V
REF196	4.096 V
REF190	Adjustable, 2.0 – 6.0 volts

- Highest Accuracy (E Grade):
  - » ± 2 mV max Initial
  - » ± 5 ppm/ °C max Drift
- Excellent Line and Load Regulation:
  - » Line: 4 ppm/V max
  - » Load: 4 ppm/mA max
- Low Dropout Voltage typ 300 mV
- Low Noise: 50 uV p-p, 0.1 - 10 Hz
- 30 mA Output Current Capability
- Low Power Consumption:
  - » 45 uA Normal Mode
  - » 15 uA Sleep Mode
- Extended ***HOT*** *Industrial Temp Range*

** Preliminary Technical Information*

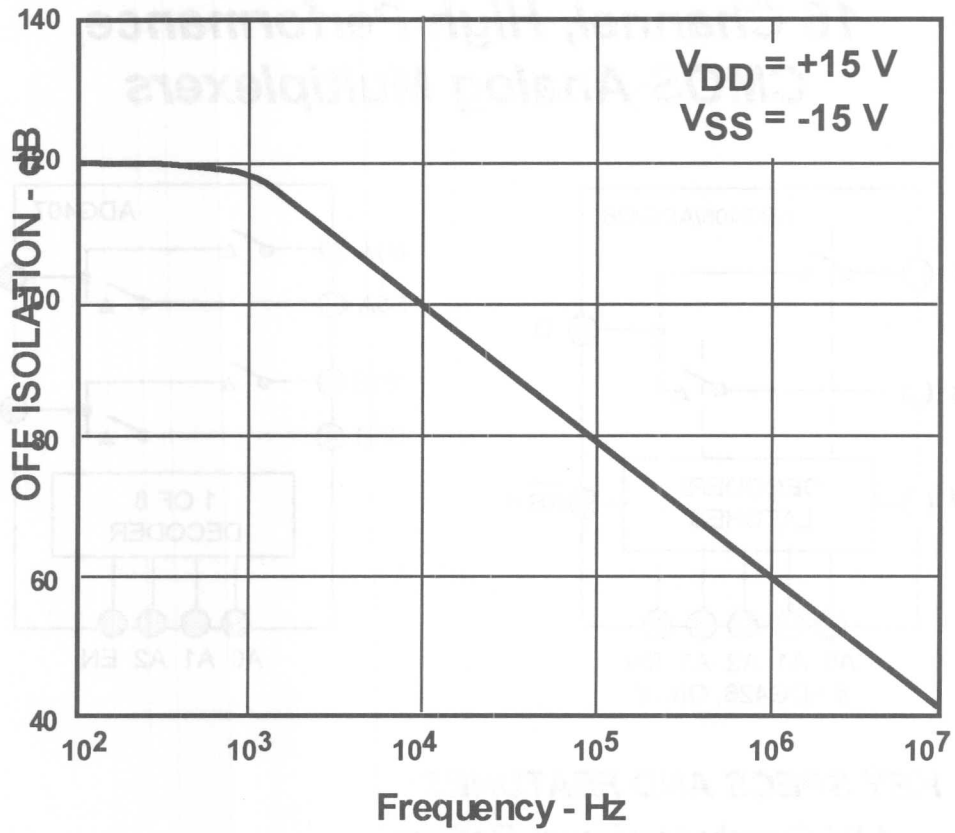
ADG406/407/426
16 Channel, High Performance, CMOS Analog Multiplexers





KEY SPECS AND FEATURES:

- 44V Supply Maximum Ratings
- Analog Signal Range Extends from V_{dd} to V_{ss}
- Low On Resistance: 50 ohms typ, 80 ohms max
- Fast Break-Before-Make Switching:
  - t_{on} : 160 ns max
  - t_{off}: 150 ns max
- Low Power Consumption (V_{dd}, V_{ss} = 15V):
  - typ 100 uA, V_{EN} = 2.4V
  - typ 1 uA, V_{EN} = 0 V
- Improved, Plug-In Replacement for DG406 and DG407
- Plug-In Upgrade to DG506A/ADG506A, DG507A/ADG507A and DG526/ADG526A
- 28-Pin DIP, PLCC and SSOP Packages

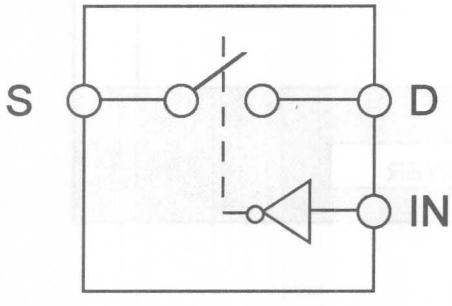


OFF Isolation and Crosstalk vs Frequency

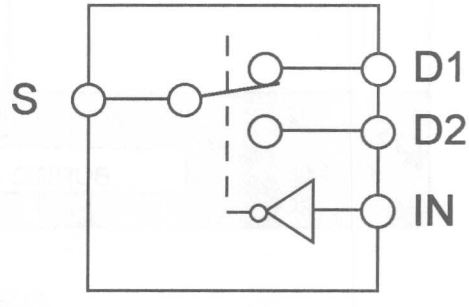
ADG417 and ADG419
Single SPST and SPDT, Low Leakage, Low R_{on} CMOS Switches

The ADG417 (SPST) and ADG419 (SPDT) are precision, monolithic CMOS switches that combines low power dissipation with high speed switching, low on resistance and low leakage currents.

ADG417



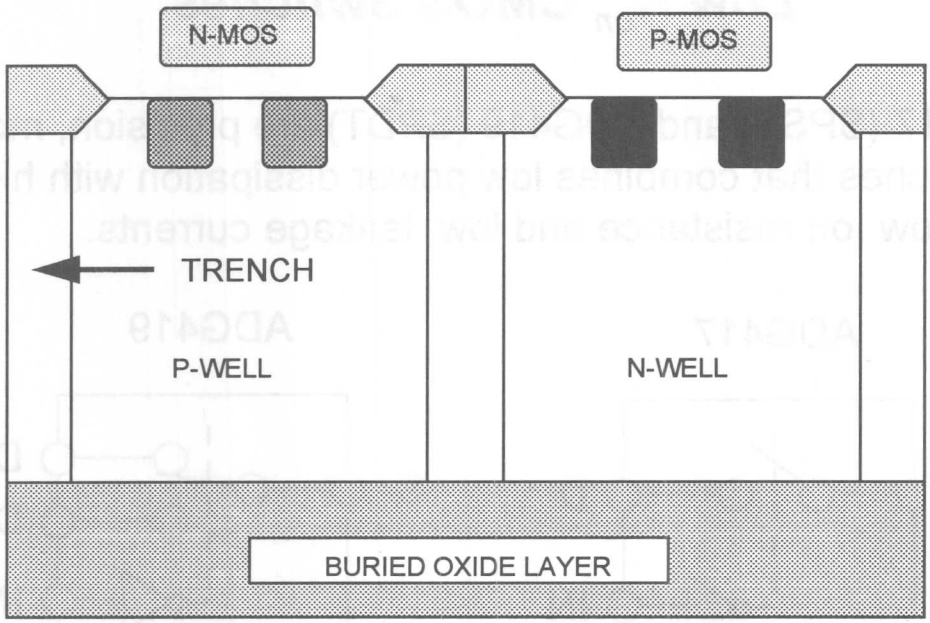
ADG419



KEY SPECS AND FEATURES:

- Improved, Plug-In Replacements for DG417 and DG419
- Low On Resistance: < 35 ohms
- Low Power Dissipation: < 35 uW
- Faster Transition Time: 100 ns, max
- Trench Isolation Eliminates Latch-Up
- Break-Before-Make Switching Action (ADG419)
- V_{SS} to V_{DD} Analog Signal Range
- 8-Pin Plastic DIP, Narrow Body SOIC and CerDIP (ADG419, only) Packages
- -40 deg C to +85 deg C Operation

WHAT IS TRENCH ISOLATION?

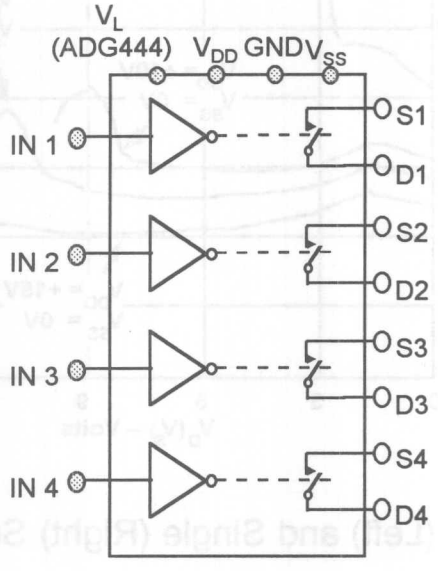


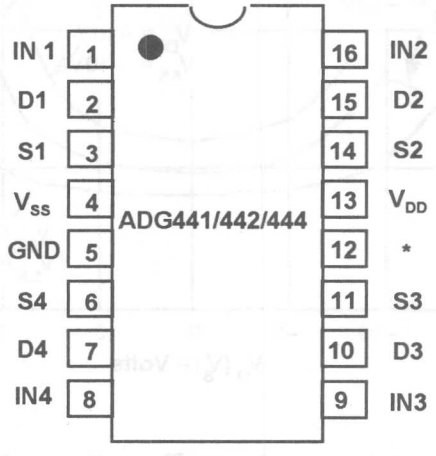
In normal junction isolation, the N and P wells of the PMOS and NMOS transistors form a diode which is reverse biased under normal operating conditions. During overvoltage conditions, this diode becomes forward biased. A silicon-controlled rectifier type circuit is formed by the two transistors causing a significant amplification of current which, in turn, leads to latch up.

In the ADG417 and ADG419, an insulating oxide layer (trench) is placed between the NMOS and PMOS transistors of the CMOS switch. The parisitic junction (SCR) is eliminated, resulting in a completely latch-proof switch.

Another advantage is the much lower leakage current of trench isolation (0.25 nA vs several nA).

ADG441/ADG442/ADG444
Precision Quad SPST CMOS Switches

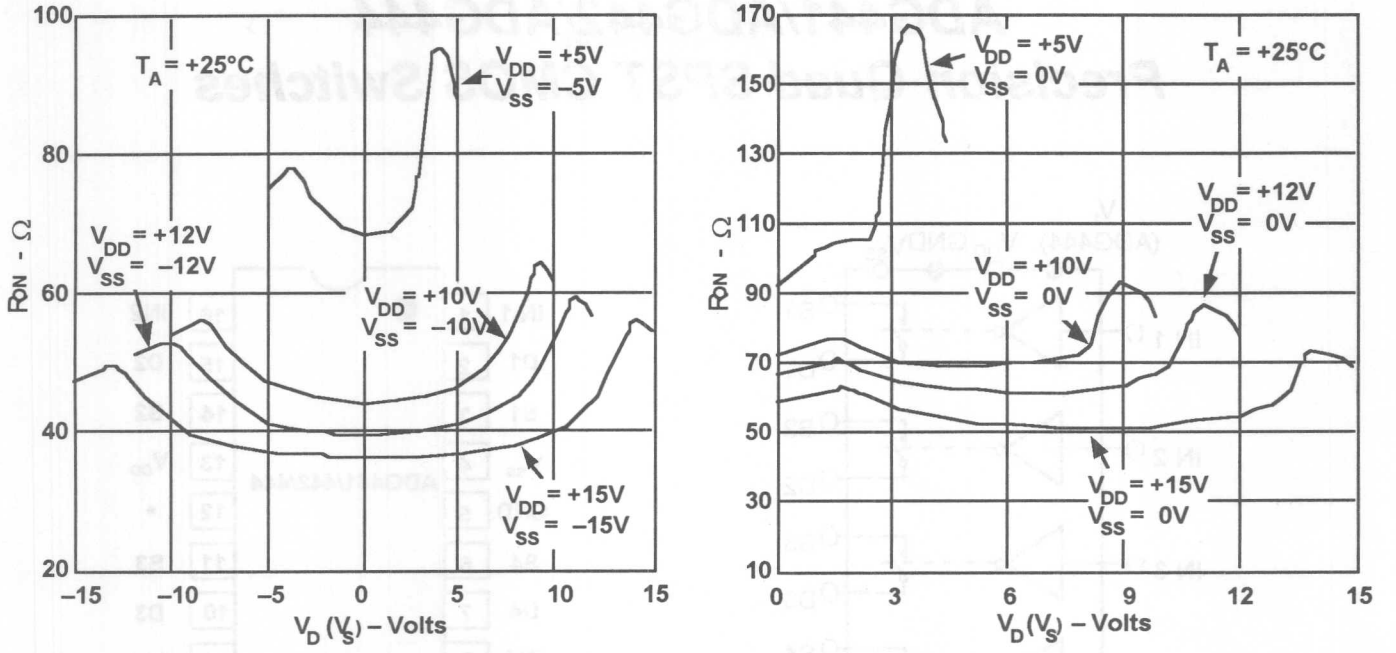




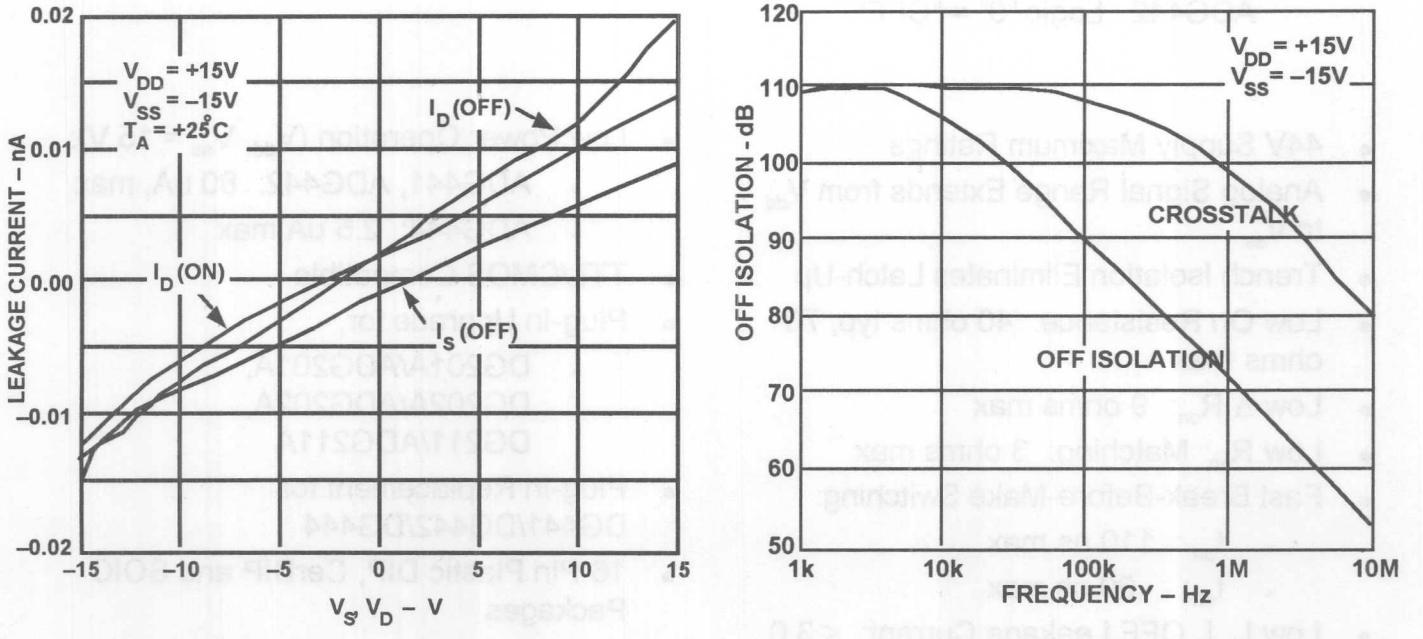
* ADG441, ADG442 : NC
ADG444 : V_L

ADG441, ADG444 :Logic "0" = "ON"
ADG442 : Logic "0" = "OFF"

- 44V Supply Maximum Ratings
- Analog Signal Range Extends from V_{dd} to V_{ss}
- Trench Isolation Eliminates Latch-Up
- Low On Resistance: 40 ohms typ, 70 ohms max
- Low ΔR_{on}: 9 ohms max
- Low R_{on} Matching: 3 ohms max
- Fast Break-Before-Make Switching:
  - t_{on} : 110 ns max
  - t_{off}: 60 ns max
- Low I_d, I_s OFF Leakage Current: < 3.0 nA max
- Low Power Operation (V_{dd}, V_{ss} = 15 V):
  - ADG441, ADG442: 80 uA, max
  - ADG444: 2.5 uA max
- TTL/CMOS Compatible
- Plug-In Upgrade for,
  - DG201A/ADG201A, DG202A/ADG202A, DG211/ADG211A
- Plug-In Replacement for DG441/DG442/DG444
- 16-Pin Plastic DIP, CerDIP and SOIC Packages



On Resistance As a Function of V_d (V_s) Dual (Left) and Single (Right) Supplies

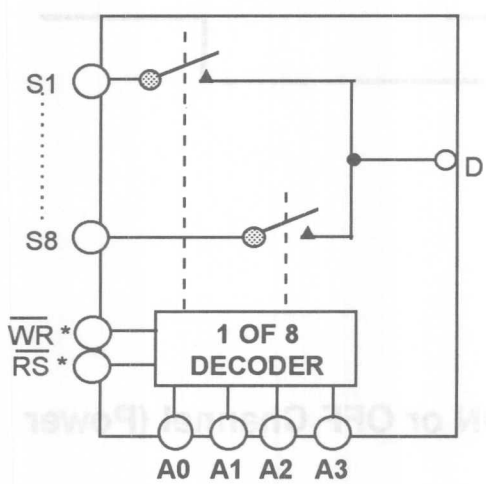


Leakage Current (Left) and Crosstalk and OFF Isolation (Right) As a Function of Frequency

ADG508F/ADG509F/ADG528F/ADG529F
4/8 Channel Fault-Protected Multiplexers

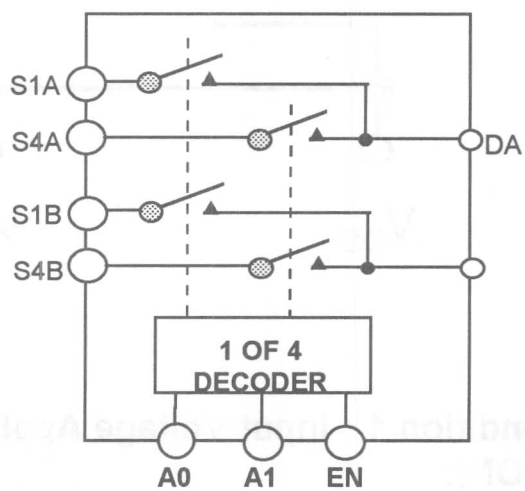
The ADG508F (8:1), ADG509F (4:1) and ADG528F (latched 8:1) patented design provides overvoltage and power fault conditions up to ± 35 volts with no tradeoff in performance and at no extra cost!

ADG508F/ADG528F



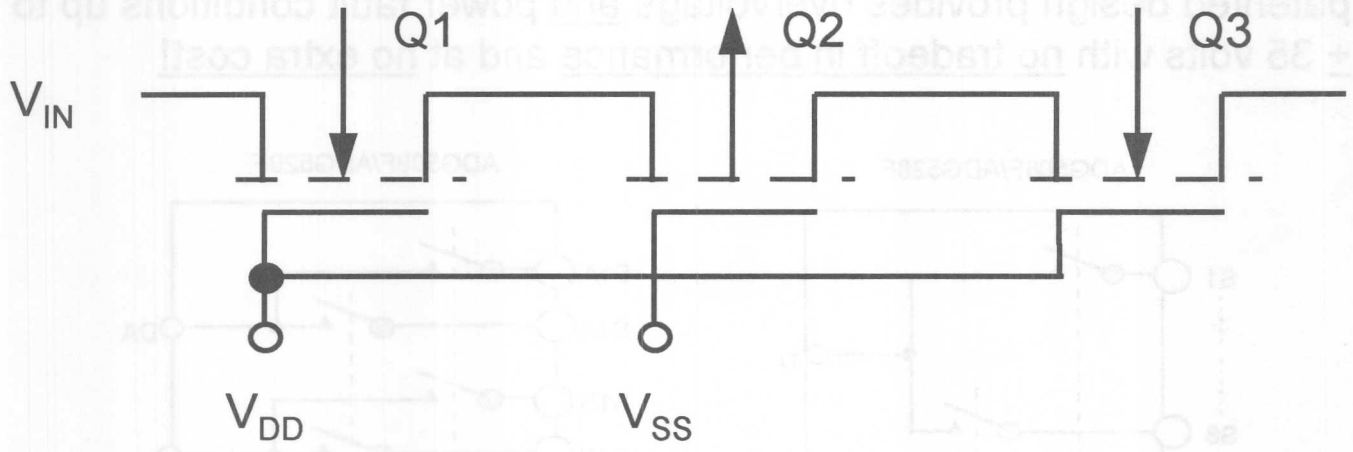
* ADG528F only

ADG509F/ADG529F



- Direct, Plug-In Replacement for ADI's ADG508A, ADG509A and ADG528A Multiplexers.
- Analog Input Fault Protection:
  - V_{DD} + 20V, V_{SS} - 20V with Power OFF
  - ± 35V with Power ON
- Low ON Resistance : 300 Ω typ vs 1500-2000 Ω typ for other, so-called "Fault-Protection" Designs
- Faster Switching Times : 250 ns vs 1000 ns for "Other" Designs
- Lower Input Leakage in Overvoltage Condition : 2 uA vs 10 uA for "Other" Designs
- Latch-up Proof Construction (Trench Isolation)
- Break Before Make Construction
- TTL and CMOS Construction
- 16 Pin Plastic DIP (N), CerDIP (Q) and PLCC (P) Packages
- Operating Temperature Ranges:
  - -40 deg C to +85 deg C : N, P
  - -55 deg C to +125 deg C : Q

How the Input Fault Protection Works:



Condition 1 : Input Voltage Applied to ON or OFF Channel (Power ON):

- When V_{SS} + 3.0V < V_{IN} < V_{DD} - 1.5V, Normal Operation, all MOSFETS ON, R_{ON} ≤ 400 ohms
- When V_{IN} ≥ V_{DD} - 1.5V (Up to +35V), Q1 or Q3 Turns OFF
- When V_{IN} ≤ V_{SS} + 3.0V, (Down to -35V), Q2 Turns OFF

Condition 2: Input Voltage Applied with Power Supplies OFF:

- Positive Overvoltage Up to +35V, Q1 OFF
- Negative Overvoltage Down to -35V, Q2 OFF

SECTION 6
AUDIO PRODUCTS

Voltage-Controlled Amplifiers

Digital Volume Control

Stereo A-D and D-A Converters

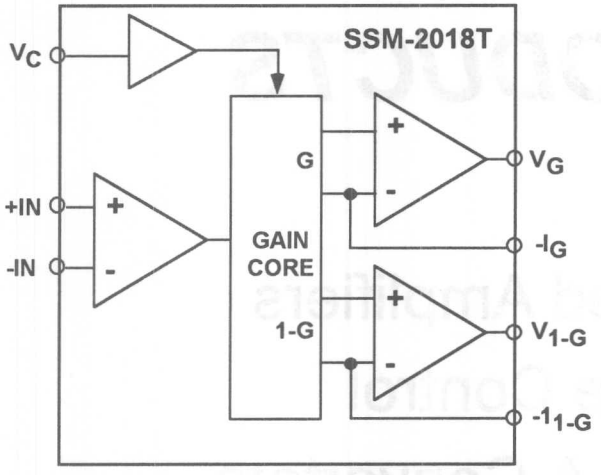
Sample-Rate Converters

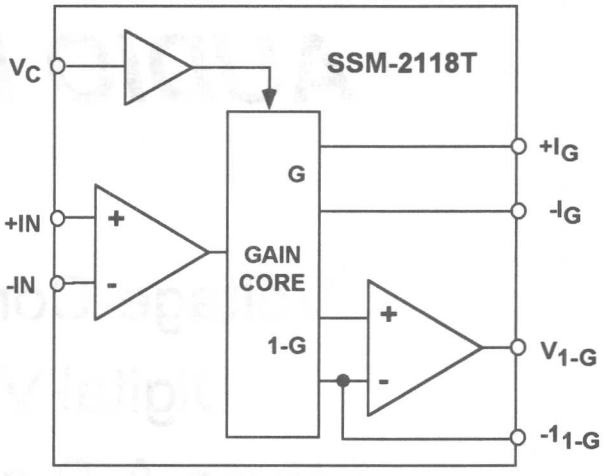
Dual Channel Sigma-Delta Modulator

Parallel/Serial Port SoundPort@ Stereo Codecs

SSM2018T/SSM2118T
"Trimless" Voltage-Controlled Amplifiers

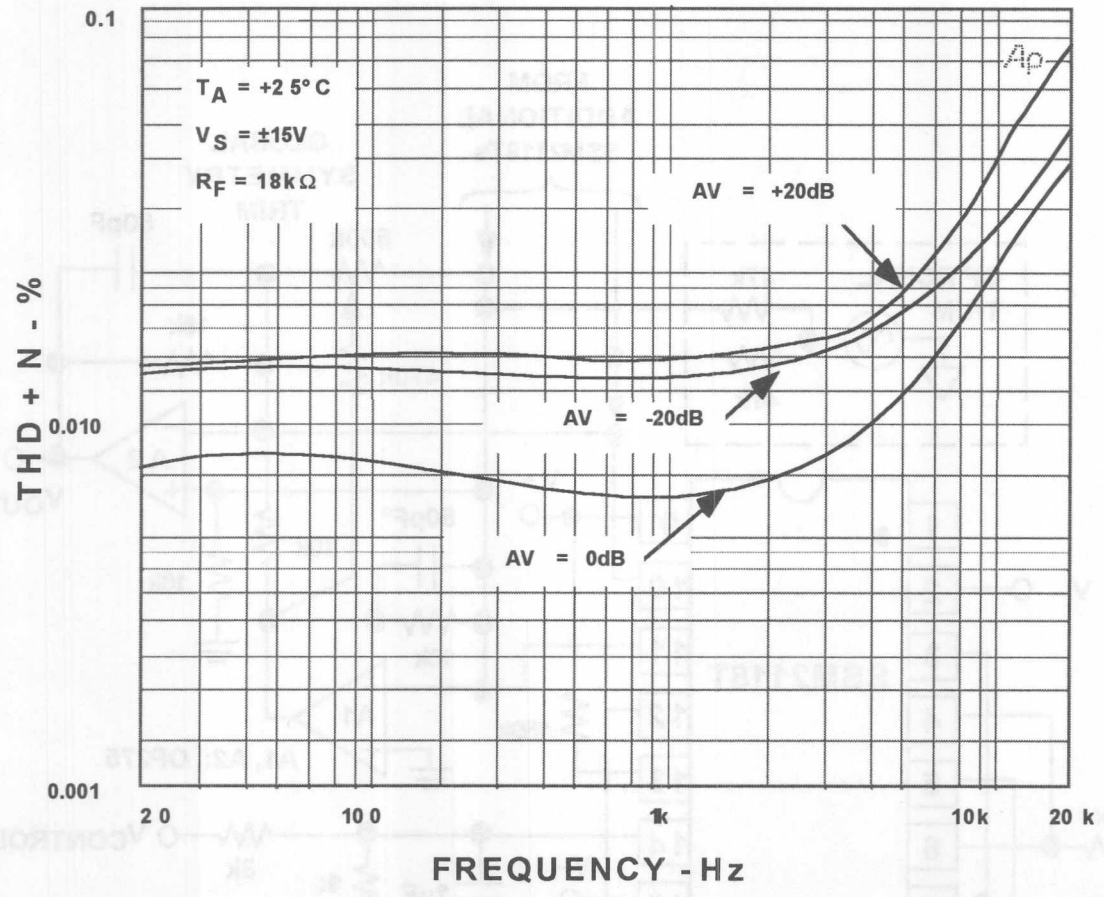
The SSM2018T and SSM2118T are the first, professional audio-quality VCAs to offer trimless operation!



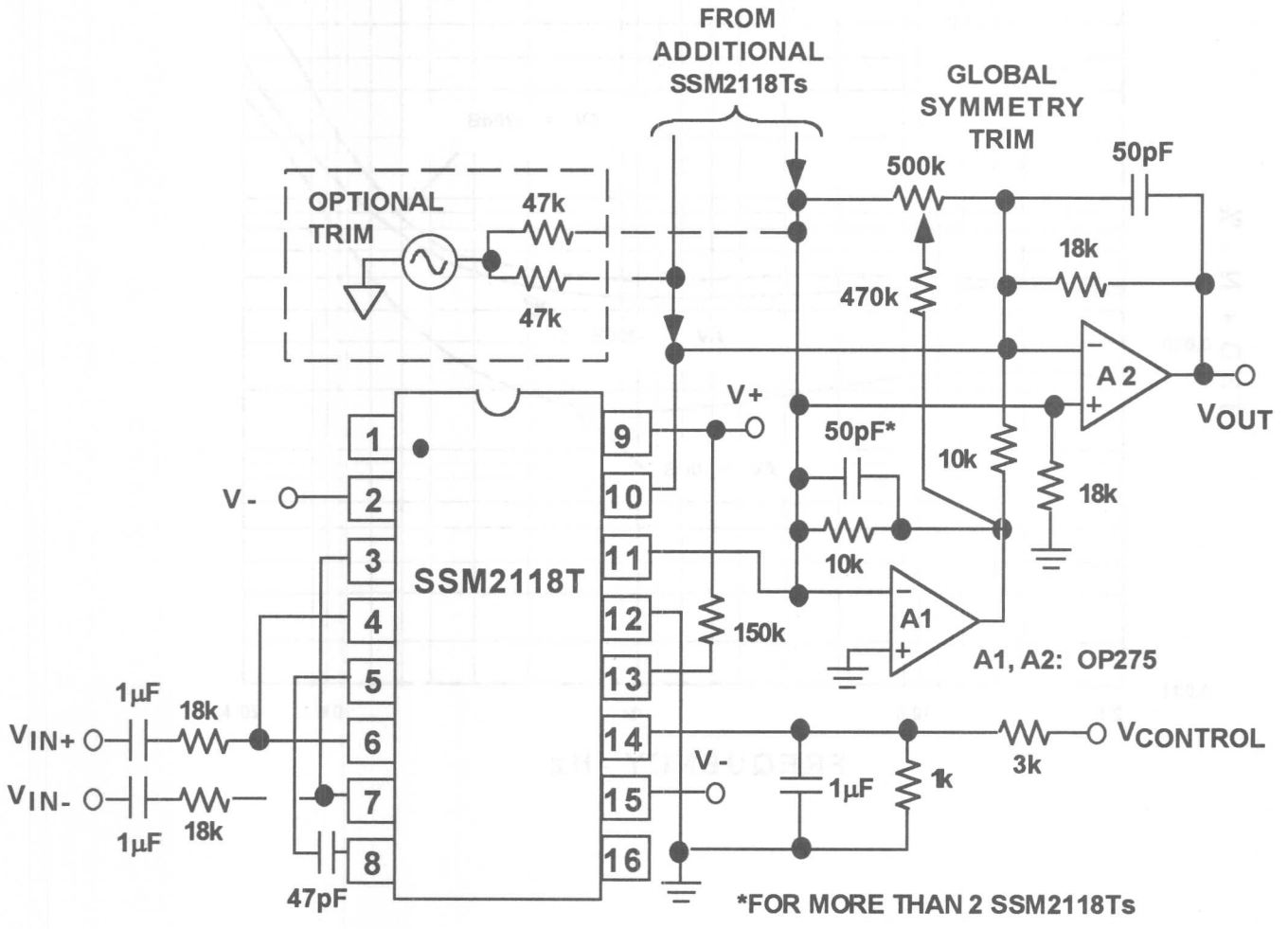


KEY SPECS AND FEATURES:

- Voltage (SSM2018T) or Current (SSM2118T) Versions
- No Trimming Required
- Noise Typically -95 dBu, 20 kHz Bandwidth
- Total Harmonic Distortion & Noise typ 0.006 % @ 1kHz, Unity Gain
- 117 dB Dynamic Input Range
- 140 dB Gain Range: -30 mV/dB Control
- Differential Inputs
- Complimentary Gain Outputs
- Power Supply Range from ± 5V to ± 18V
- 16-Pin Epoxy DIP and SOIC Packages



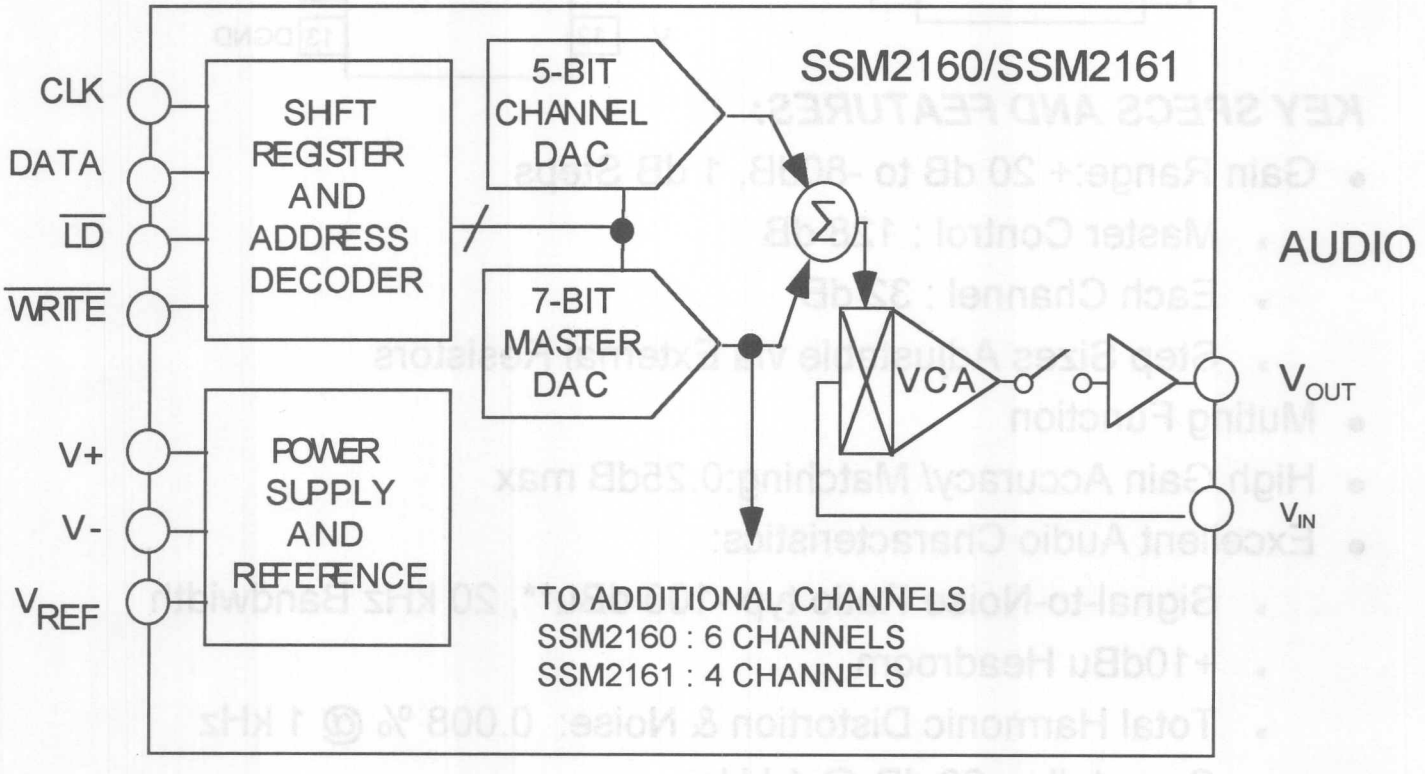
SSM2018T Typical Total Harmonic Distortion and Noise vs Frequency (80 kHz Low Pass Filter)



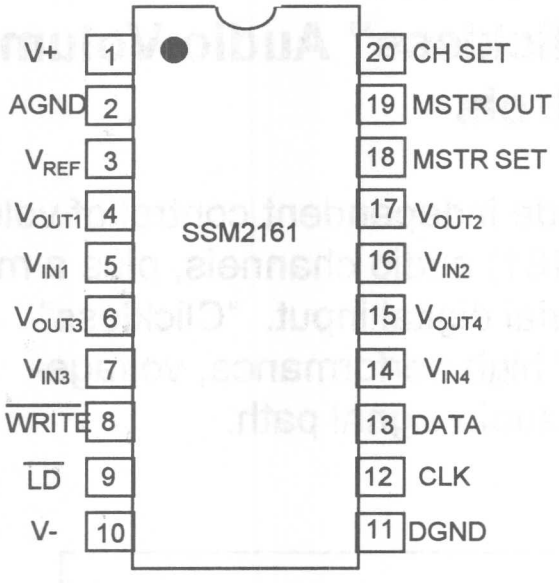
SSM2118T Typical Bus Summing Application Circuit

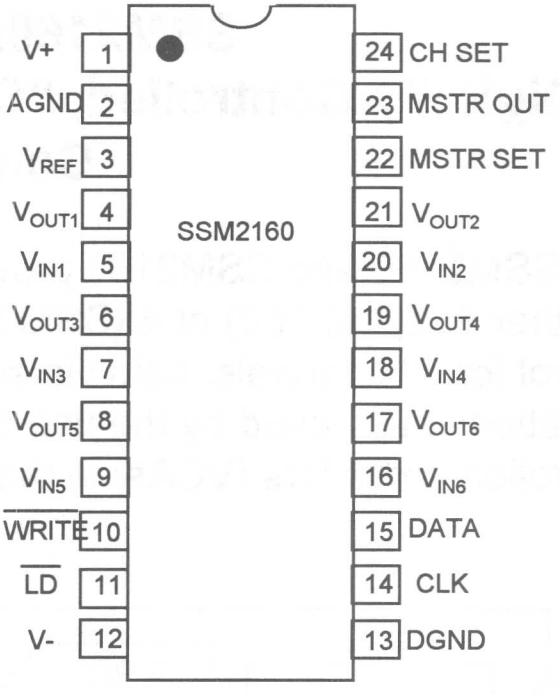
SSM2160/SSM2161*
Digitally-Controlled, "Clickless" Audio Volume Controls

The SSM2160 and SSM2161 provide independent control of volume of either 6 (SSM2160) or 4 (SSM2161) audio channels, plus a master control for all channels, both via serial digital input. "Clickless" operation is achieved by the use of high performance, voltage-controlled amplifiers (VCAs) in the audio signal path.



**Preliminary Technical Information*

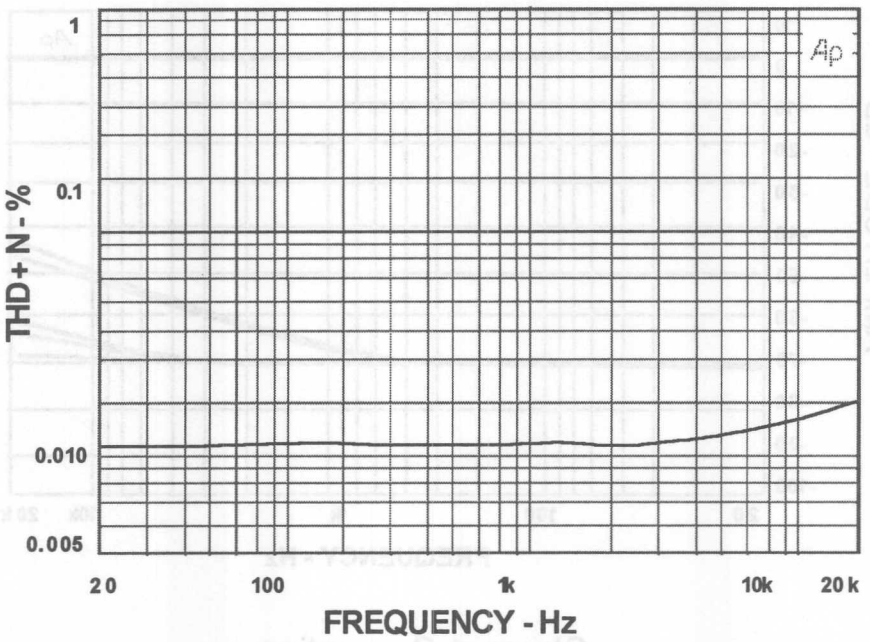




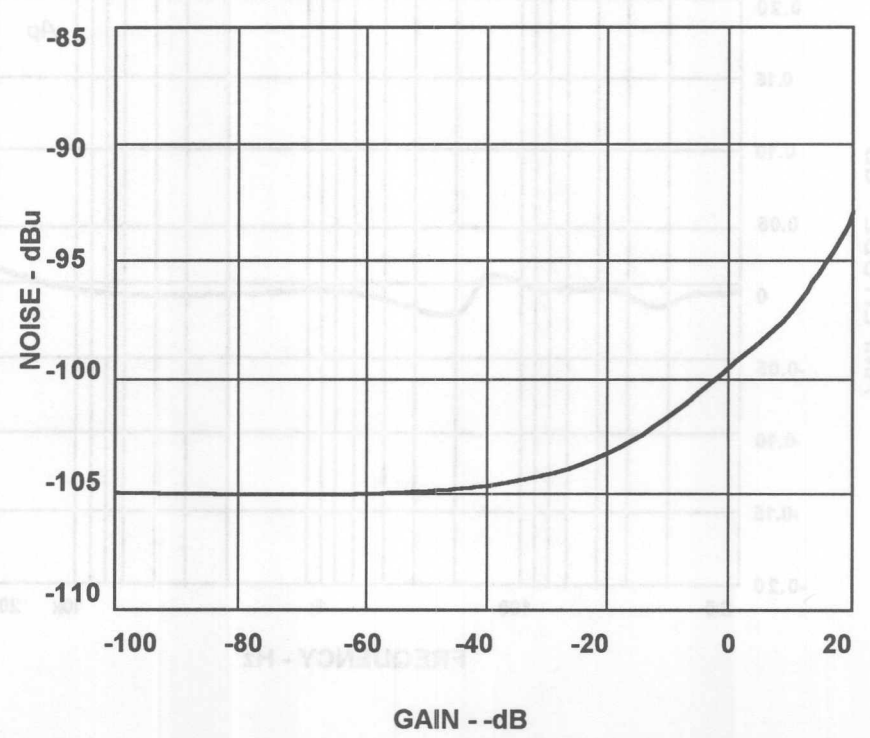
KEY SPECS AND FEATURES:

- Gain Range:+ 20 dB to -80dB, 1 dB Steps
  - » Master Control : 128 dB
  - » Each Channel : 32 dB
  - » Step Sizes Adjustable via External Resistors
- Muting Function
- High Gain Accuracy/ Matching:0.25dB max
- Excellent Audio Characteristics:
  - » Signal-to-Noise Ratio typ -100 dBu**, 20 kHz Bandwidth
  - » +10dBu Headroom
  - » Total Harmonic Distortion & Noise: 0.008 % @ 1 kHz
  - » Crosstalk: -80 dB @ 1 kHz
- Single (+4V to +36V) or dual (±4V to ±18V) Operation
- -40 deg C to +85 deg C Operation
- 24-Pin (SSM2160) / 20-Pin (SSM2161) Plastic DIP and SOIC Packages

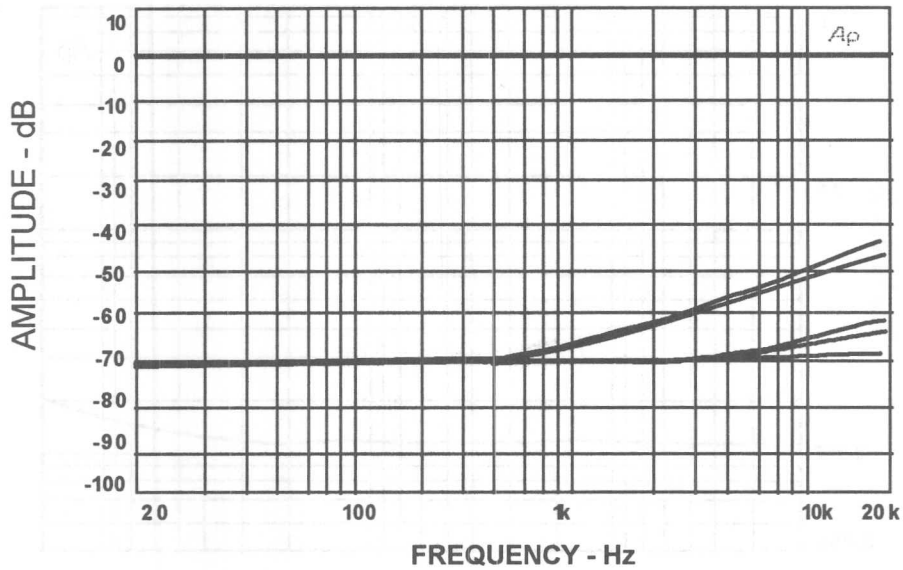
** 0 dBu = $0.775V_{rms}$



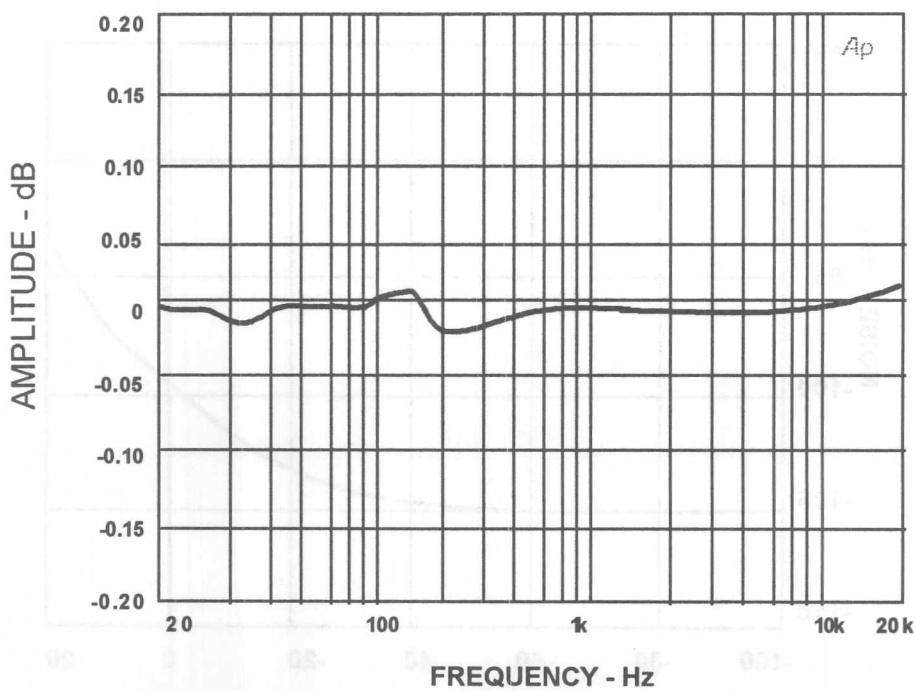
Total Harmonic Distortion and Noise vs Frequency with 80 kHz Low Pass Filter



Noise vs Gain (22 kHz Bandwidth)



Channel Separation



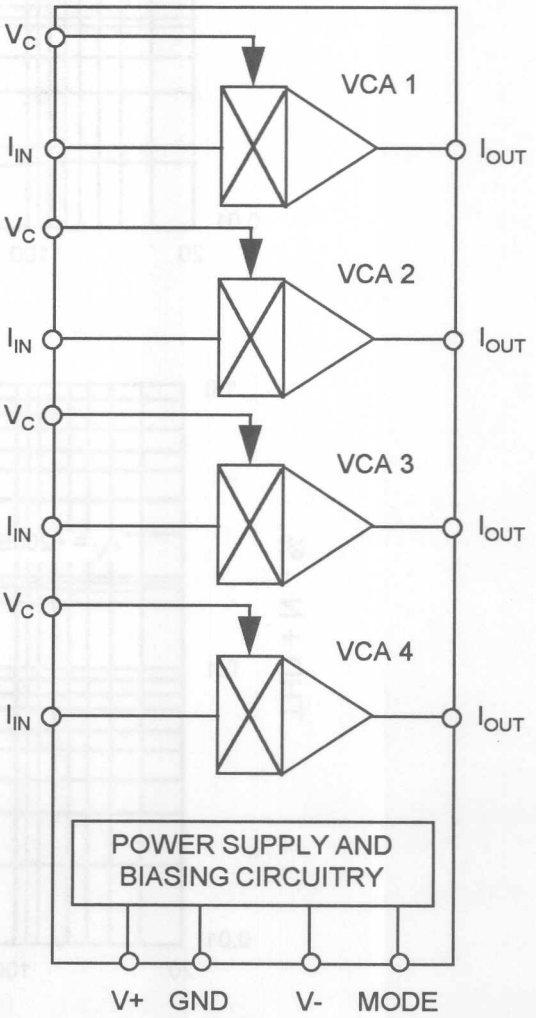
Frequency Response

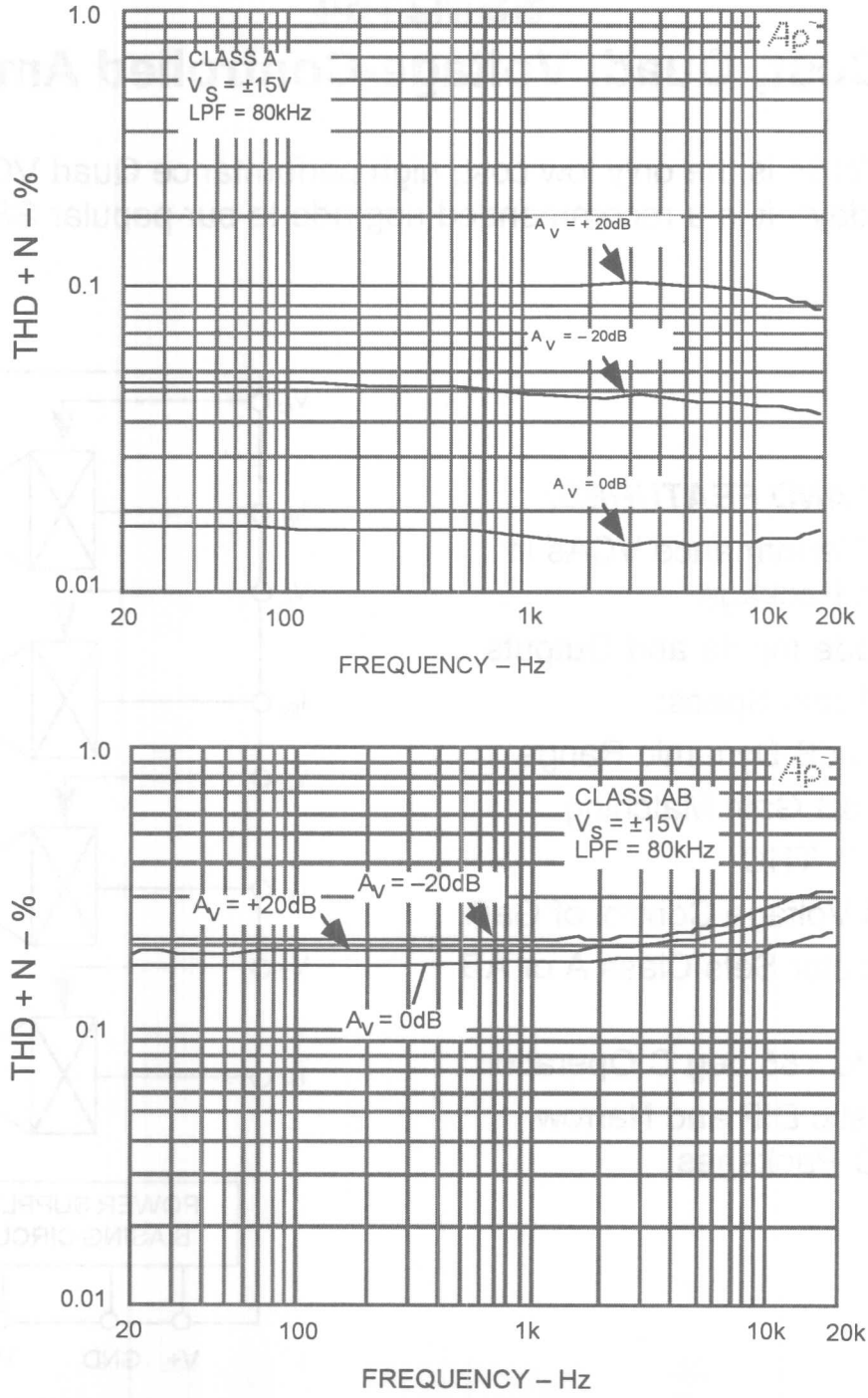
SSM2164
Low Cost, Quad, Voltage-Controlled Amplifier

The SSM2164 is the only low cost, high performance Quad VCA on the Market today! It is a recommended upgrade to our popular SSM2024 .

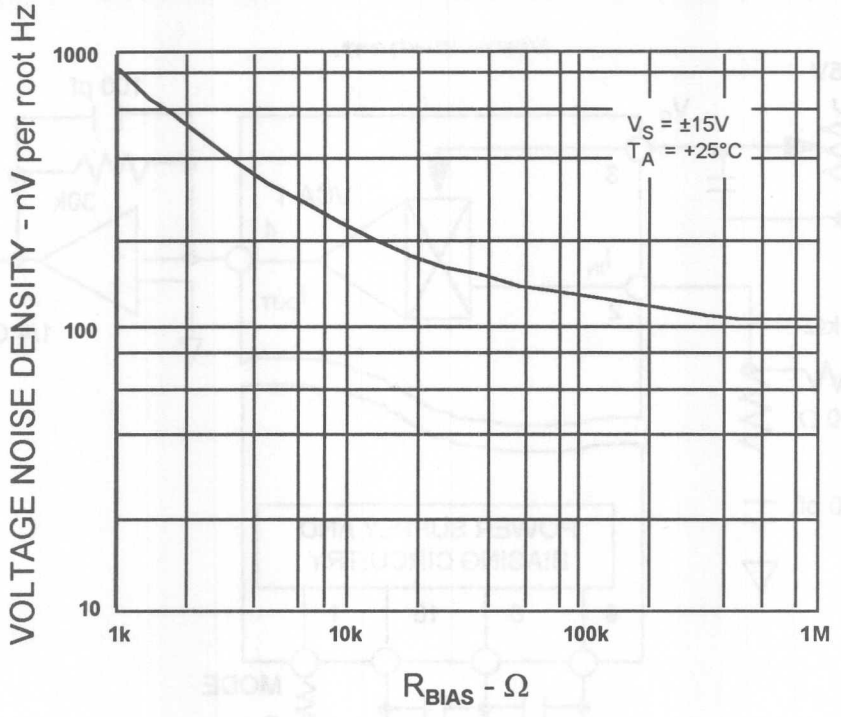
KEY SPECS AND FEATURES:

- Four High Performance VCAs in One Single Package
- Current Mode Inputs and Outputs
- Excellent Audio Specs:
  - > 100 dB Dynamic Range
  - 0.07 dB Gain Matching
  - 0.02 % THD
- -33 mV/dB Voltage Control of Gain
- Single Resistor Sets Class A or AB Operation
- -40 deg C to +85 deg C Operation
- 16 Pin Plastic DIP and Narrow Body SOIC Packages

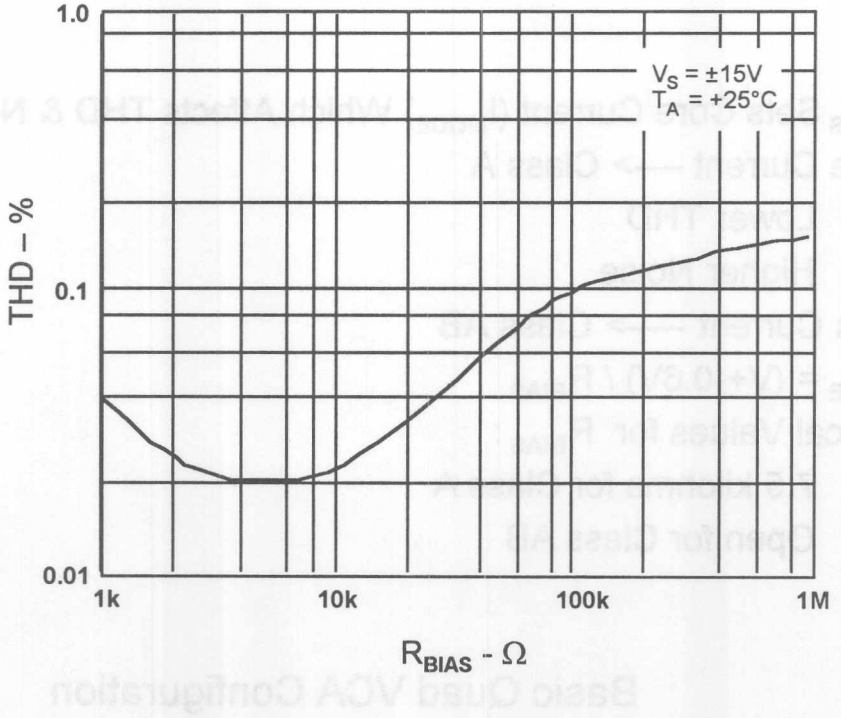




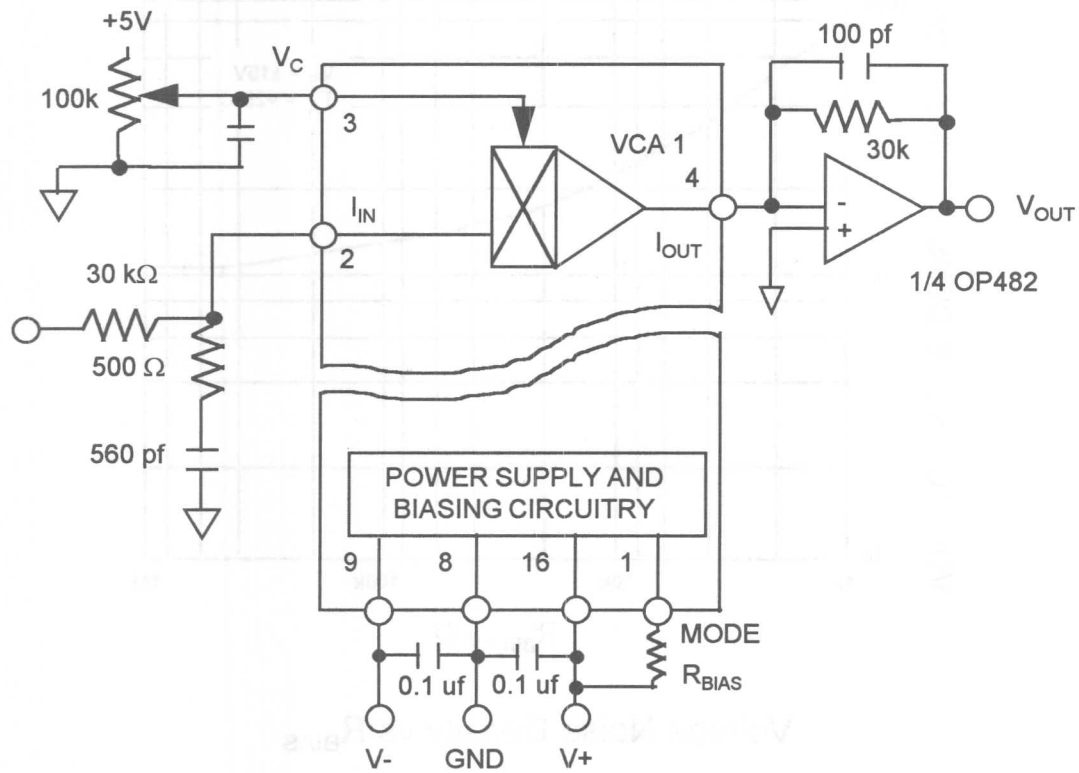
Total Harmonic Distortion & Noise vs Frequency for Class A (top) and Class AB (bottom) Operation.



Voltage Noise Density vs R_{BIAS}

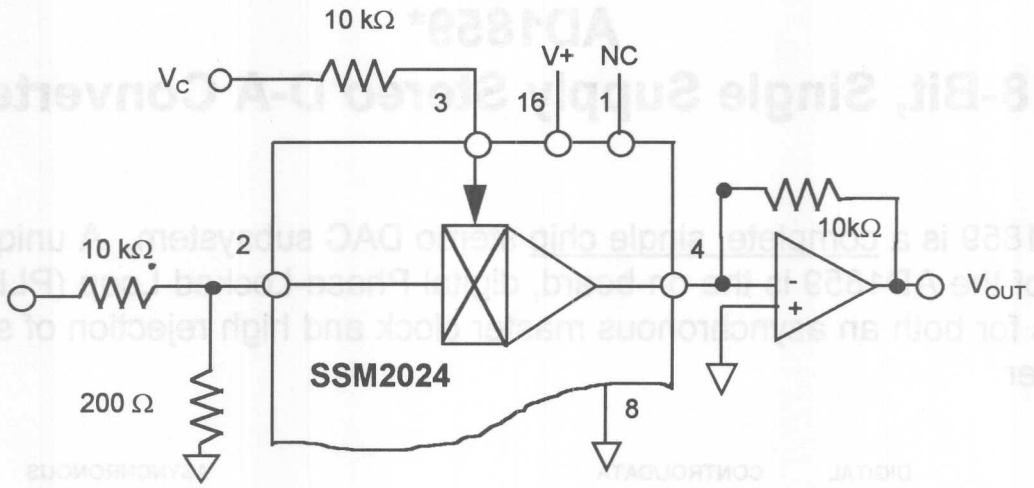


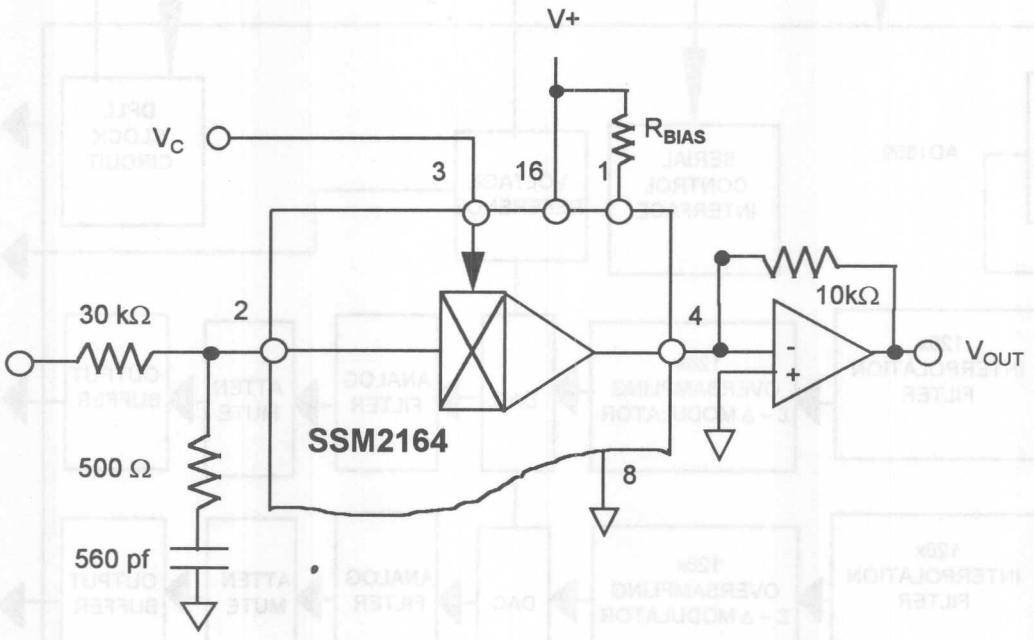
Total Harmonic Distortion vs R_{BIAS}



- R_{BIAS} Sets Core Current (I_{MODE}) Which Affects THD & Noise:
- More Current ----> Class A
  - Lower THD
  - Higher Noise
- Less Current -----> Class AB
- I_{MODE} = (V+-0.6V) / R_{BIAS}
- Typical Values for R_{BIAS} :
  - 7.5 kilohms for Class A
  - Open for Class AB

Basic Quad VCA Configuration

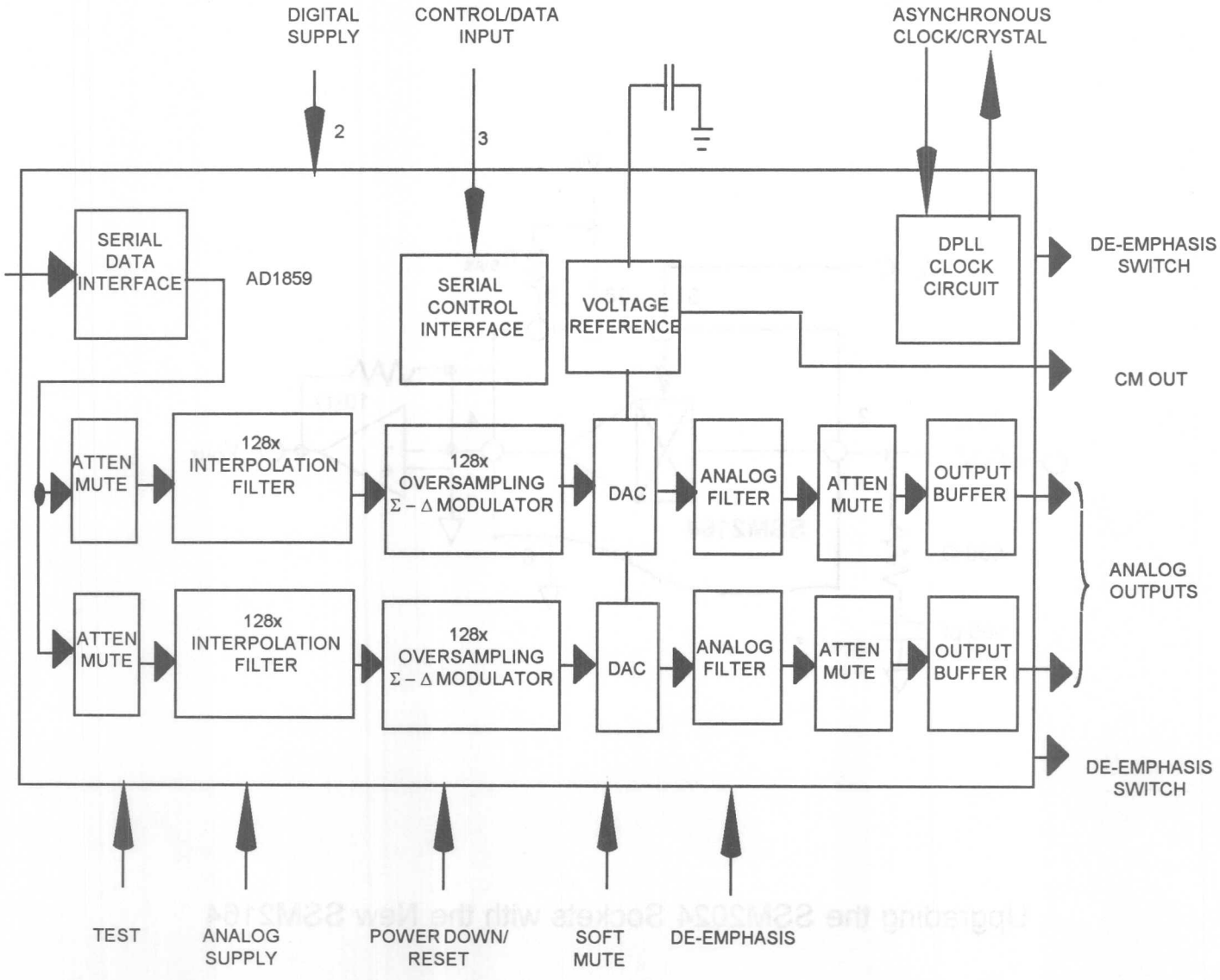




Upgrading the SSM2024 Sockets with the New SSM2164

AD1859*
18-Bit, Single Supply Stereo D-A Converter

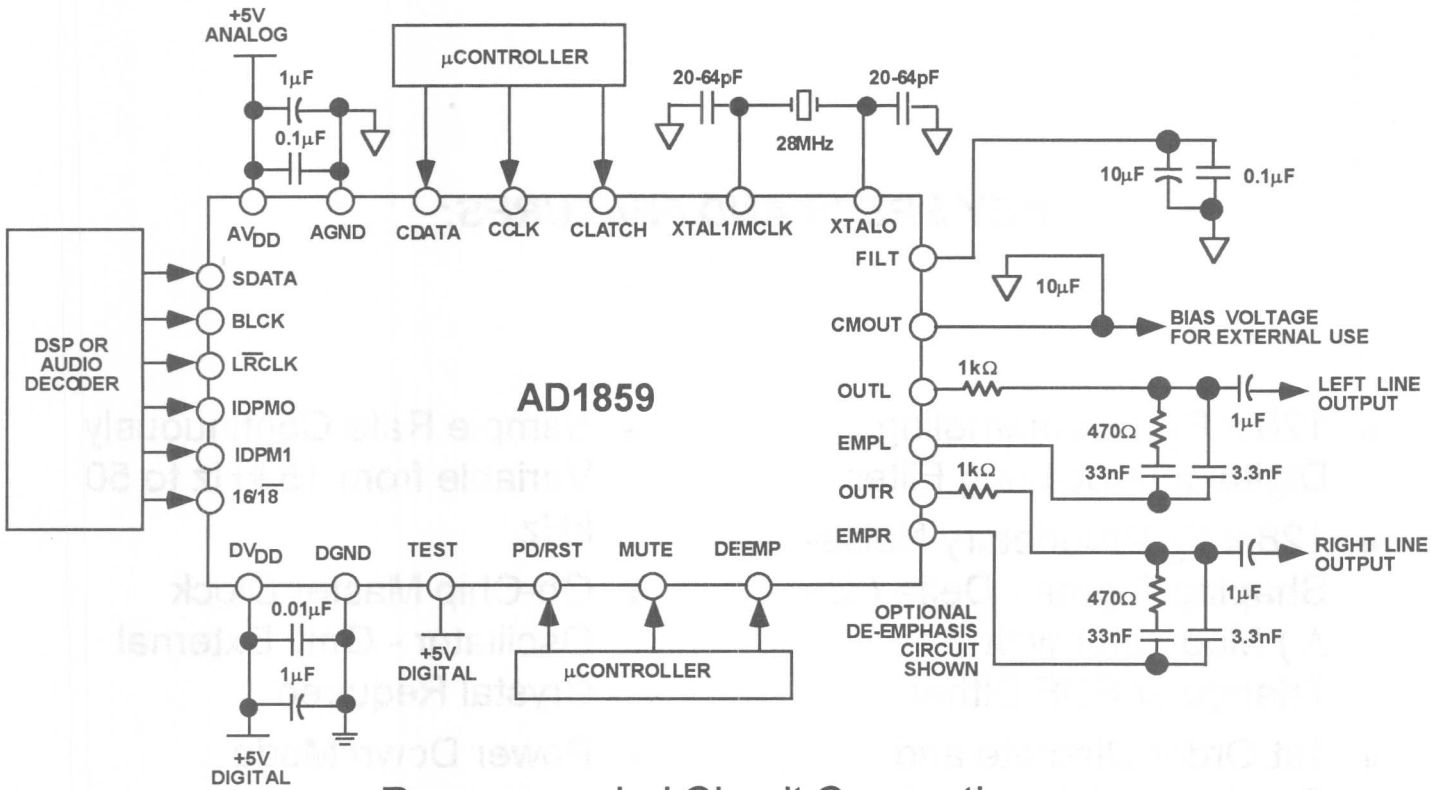
The AD1859 is a complete, single chip stereo DAC subsystem. A unique feature of the AD1859 is the on-board, digital Phase-Locked Loop (PLL), which provides for both an asynchronous master clock and high rejection of sample clock jitter.



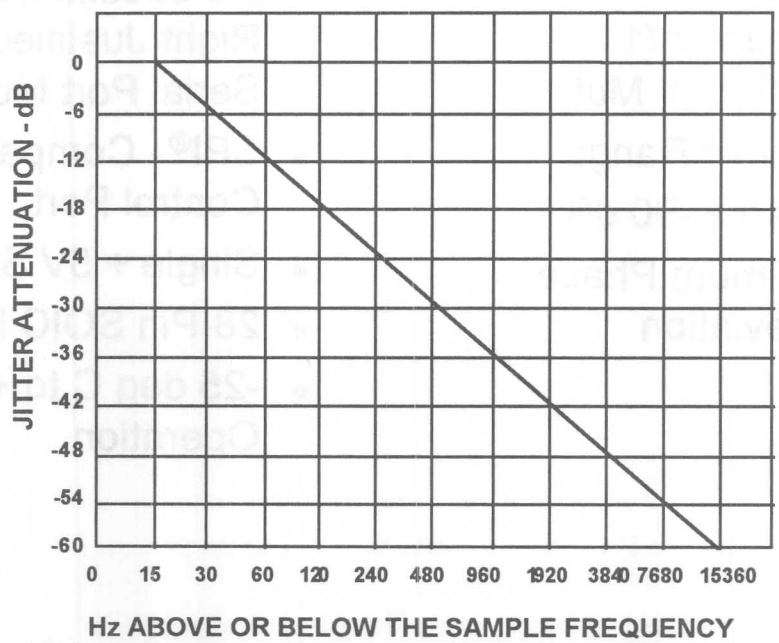
**Preliminary Technical Information*

KEY SPECS AND FEATURES:

- 128 x F_S Oversampling Digital Interpolating Filter
- 128 x F_S Proprietary Noise-Shaping Sigma - Delta (Σ - Δ) Modulator with Triangular PDF Dither
- 1st Order Discrete and Continuous Time Analog Reconstruction Filters
- 64 dB Attenuator (1 dB/step) with Soft Mute
- 96 dB Dynamic Range
- THD & Noise > -90 dB
- ± 0.2 ° Maximum Phase Linearity Deviation
- Sample Rate Continuously Variable from 15 kHz to 50 kHz
- On-Chip Master Clock Oscillator - Only External Crystal Required
- Power Down Mode
- Flexible Serial Data Port (I^2S-Justified, Left-Justified, Right-Justified and DSP Serial Port Modes)
- SPI® - Compatible Serial Control Port
- Single + 5V Supply
- 28-Pin SOIC Package
- -25 deg C to +70 deg C Operation



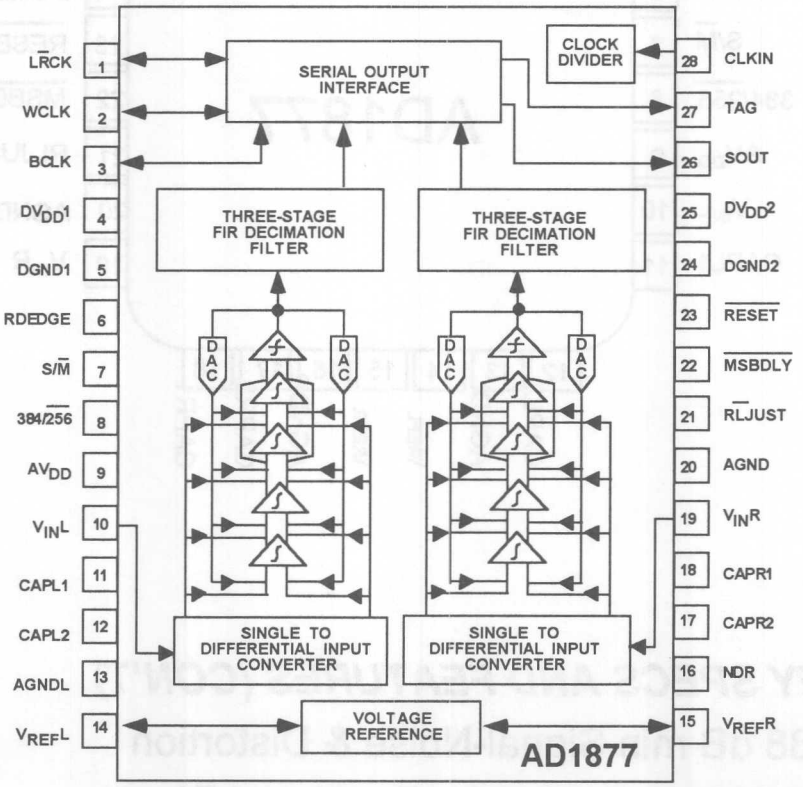
Recommended Circuit Connections



Digital Phase-Locked Loop (PLL) Jitter Rejection vs Sample Frequency

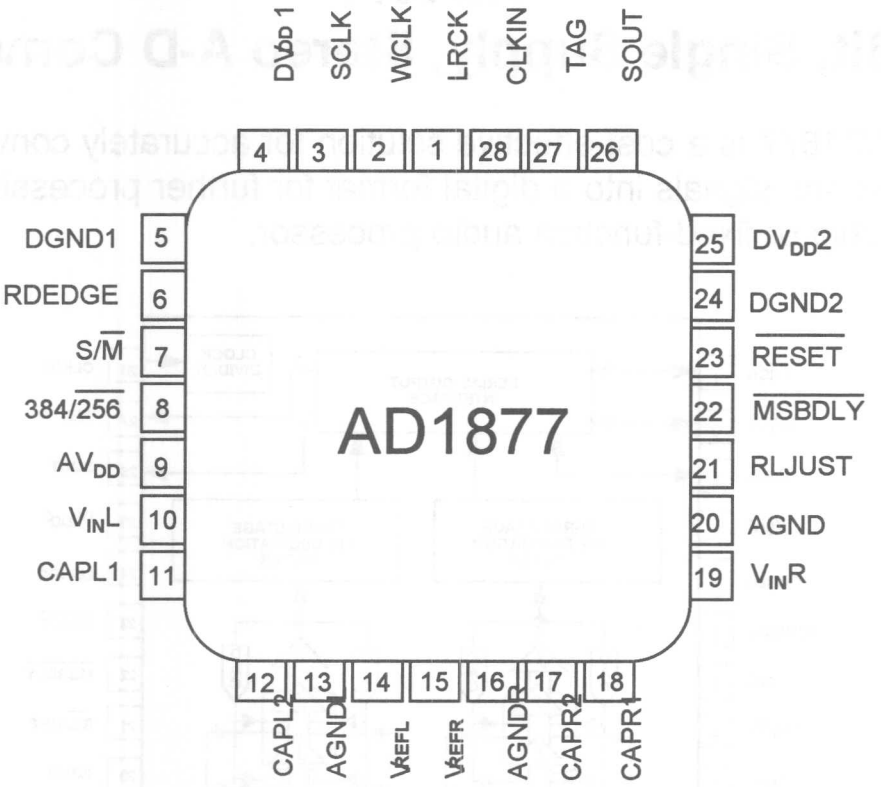
AD1877
16-Bit, Single Supply, Stereo A-D Converter

The AD1877 is a cost-effective solution for accurately converting audio-band signals into a digital format for further processing by a DSP chip or fixed-function audio processor.



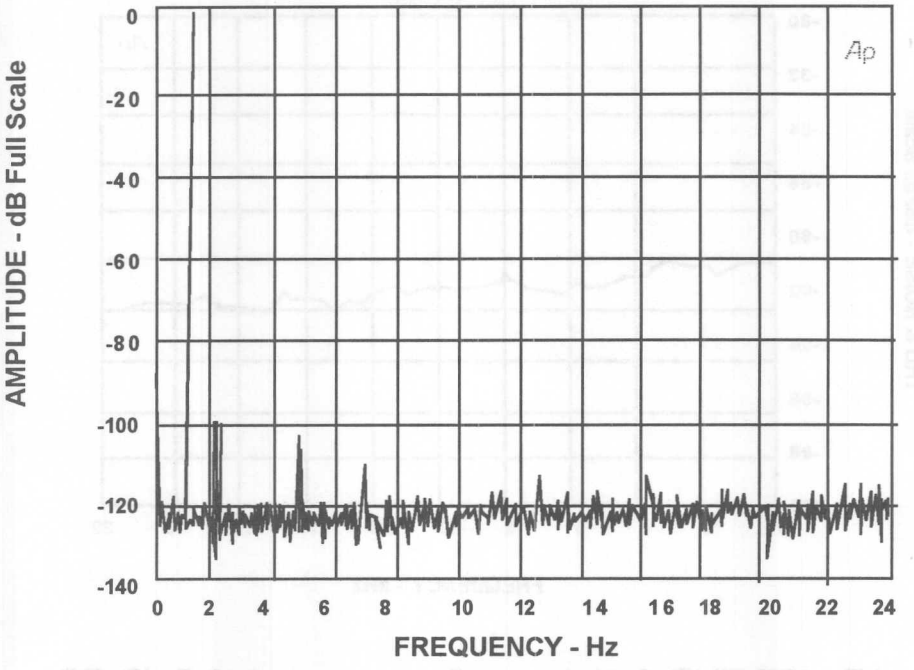
KEY SPECS AND FEATURES:

- Single-Ended, Dual-Channel Analog Inputs
- Sigma - Delta (Σ - Δ) Architecture:
- 4th Order, 64x Oversampling (Σ - Δ) Modulator
- 3 Stage, Linear Phase, FIR Decimation Filter
- 256 x F_S or 384 x F_S Input Clock
- 90 dB min Dynamic Range

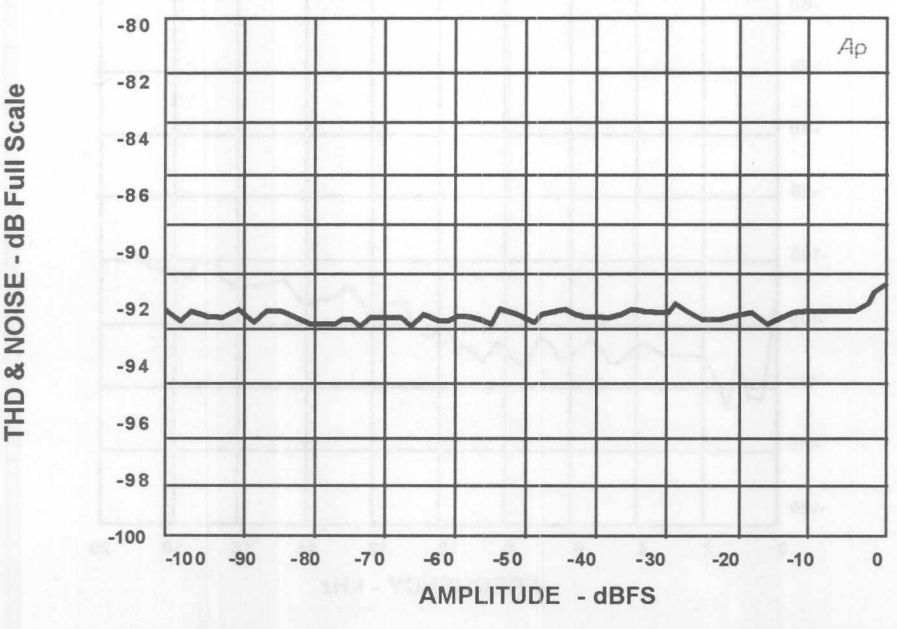


KEY SPECS AND FEATURES (CON'T)

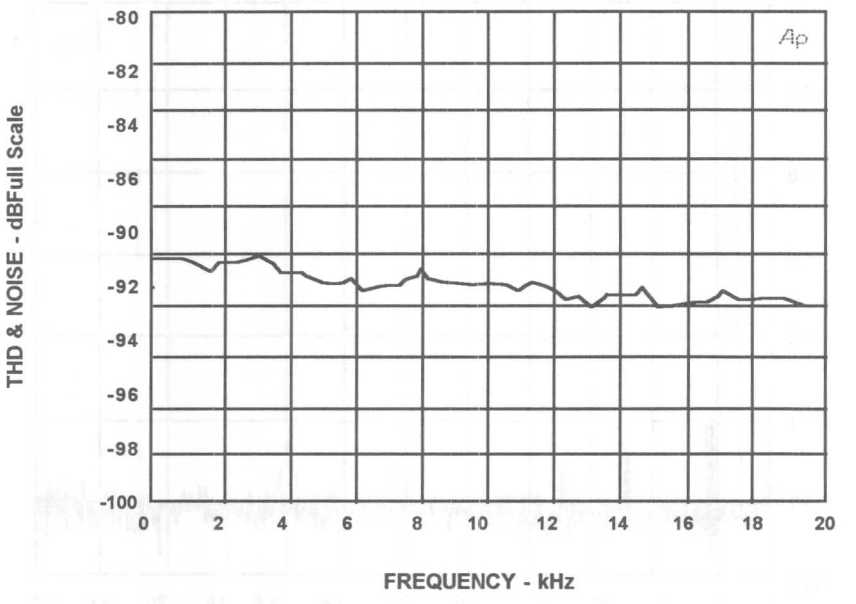
- 88 dB min Signal-Noise & Distortion
- 0.006 dB Decimator Passband Ripple
- Flexible Serial Interface
- Single + 5V Supply Operation:
  - 315 mW max Normal Mode
  - 5 uW Power-Down Mode
- 0 deg C to +70 deg C Operation
- 28-Pin SOIC Package



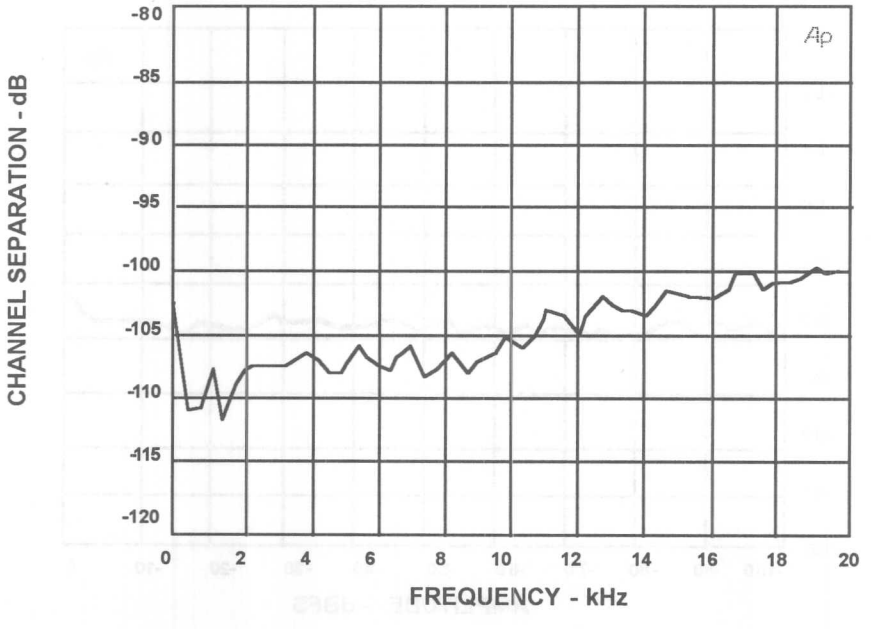
AD1877 16k Point FFT using 1 kHz Tone at -0.5 dB FS



AD1877 THD & Noise vs Amplitude for 1 kHz Tone



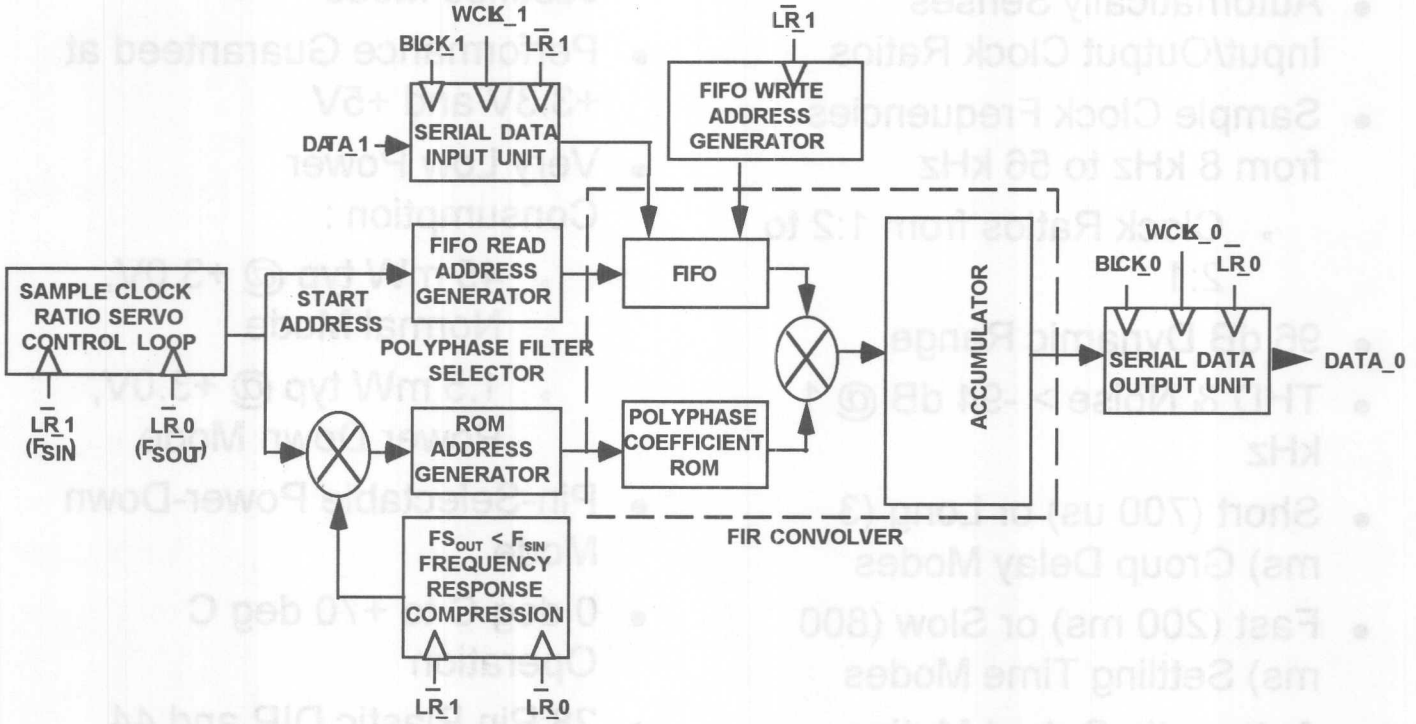
AD1877 THD & Noise vs Frequency at -0.5 dB FS



AD1877 Channel Separation vs Frequency at -0.5 dB FS

AD1893
16-Bit, SamplePort™, Stereo Asynchronous Sample-Rate Converter

The AD1893 is a low cost solution that solves the problem of interfacing between digital audio systems with different sampling rates. The AD1893 is designed primarily for 16-bit, low cost, non-varispeed applications where low voltage and power (i.e. battery-powered) operation is required.



KEY SPECS AND FEATURES:

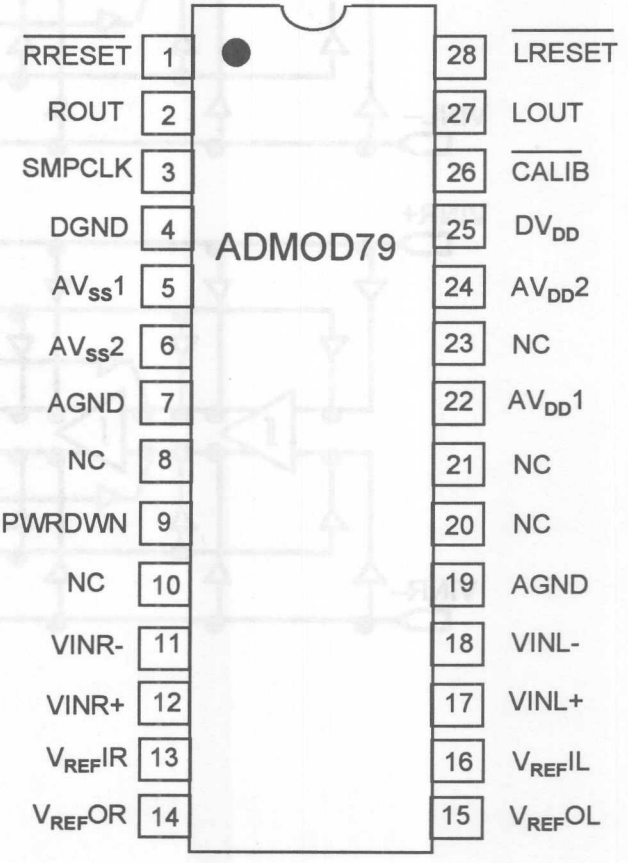
- Low Cost Version of Popular AD1890 and AD1891
- Unique Polyphase Digital Filtering for Sample-Rate Conversion
- Automatically Senses Input/Output Clock Ratios
- Sample Clock Frequencies from 8 kHz to 56 kHz
  - Clock Ratios from 1:2 to 2:1
- 96 dB Dynamic Range
- THD & Noise > -94 dB @ 1 kHz
- Short (700 us) or Long (3 ms) Group Delay Modes
- Fast (200 ms) or Slow (800 ms) Settling Time Modes
- Automatic Output Muting
- On-Chip Crystal Oscillator : 16 MHz External Crystal or Clock
- Flexible, 4-Wire Serial Interfaces Include Right-Justified Mode
- Performance Guaranteed at +3.3V and +5V
- Very Low Power Consumption :
  - 45 mW typ @ +3.0V, Normal Mode
  - 1.5 mW typ @ +3.0V, Power Down Mode
- Pin-Selectable Power-Down Mode
- 0 deg C to +70 deg C Operation
- 28 Pin Plastic DIP and 44 Pin Thin Quad Flat Pack (TQFP) Packages

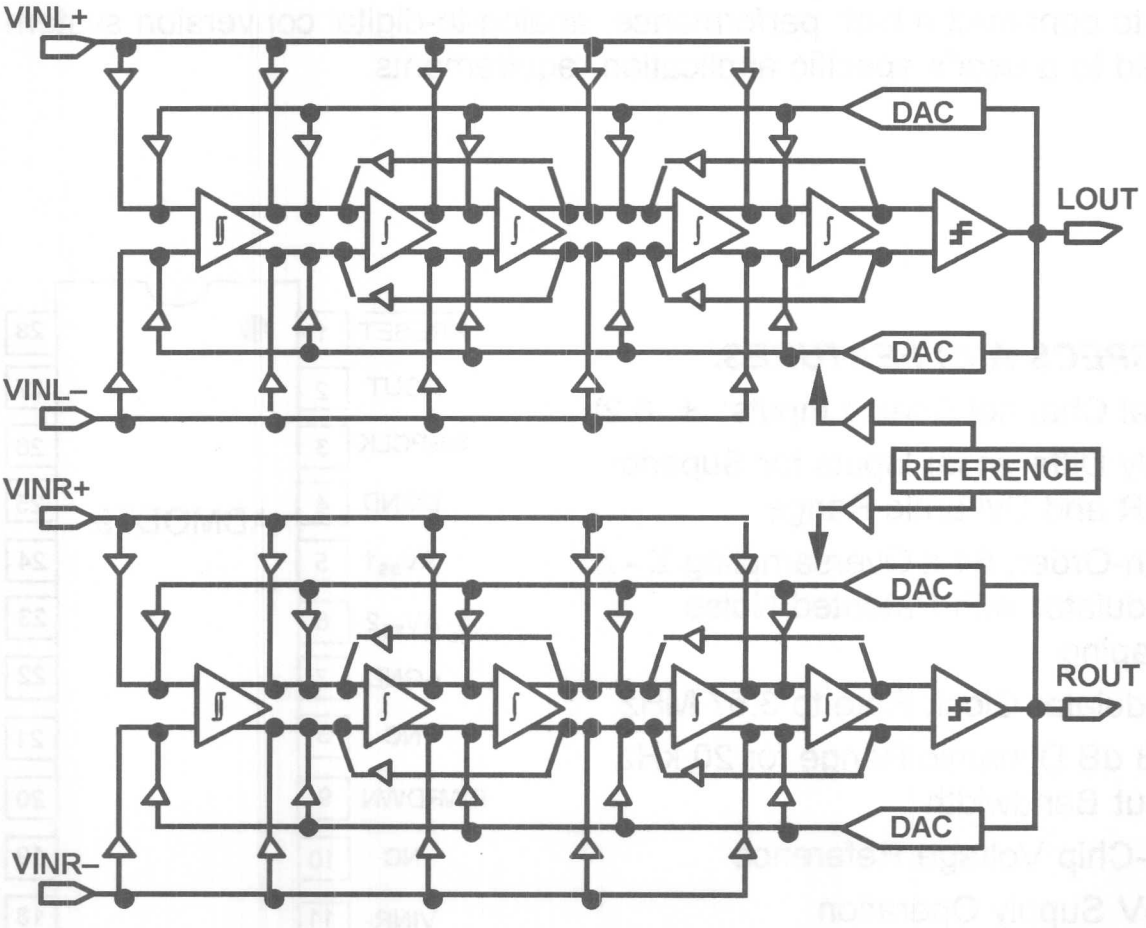
ADMOD79
Monolithic Dual-Channel, Sigma-Delta Modulator

The ADMOD79 Σ - Δ (sigma-delta) modulator is a building block which may be used to construct a high performance, analog-to-digital conversion system tailored to a user's specific application requirements.

KEY SPECS AND FEATURES:

- Dual Channel Analog Inputs: ± 6.2V
- Fully Differential Inputs for Superior SNR and Dynamic Range
- Fifth-Order, 64 x Oversampling Σ - Δ Modulator with Patented Noise Shaping
- Modulator Clock Rate to 3.57 MHz
- 103 dB Dynamic Range for 20 kHz Input Bandwidth
- On-Chip Voltage Reference
- ± 5V Supply Operation
- 0 deg C to +70 deg C Operation
- 28-Pin CerDIP Package





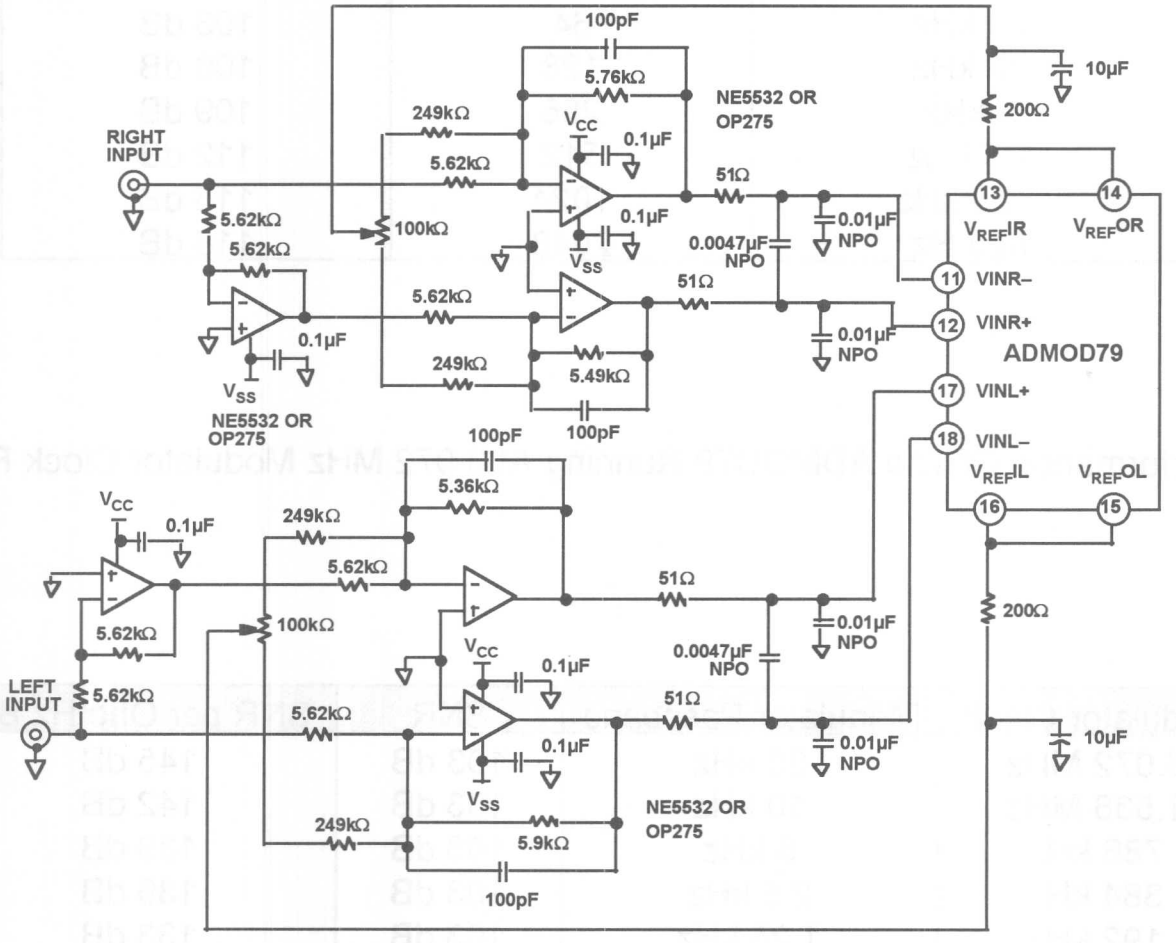
Functional Block Diagram

Filter Cut-Off Frequency	Oversampling Ratio	Signal-to-Noise Ratio
20 kHz	64	103 dB
10 kHz	128	106 dB
5 kHz	256	109 dB
2.5 kHz	512	112 dB
1.25 kHz	1024	115 dB
625 Hz	2048	118 dB

Performance Of The ADMOD79 Running At 3.072 MHz Modulator Clock Rate

Modulator Clock	Modulator Passband	SNR	SNR per One Hz Bin
3.072 MHz	20 kHz	103 dB	145 dB
1.536 MHz	10 kHz	103 dB	142 dB
786 kHz	5 kHz	103 dB	139 dB
384 kHz	2.5 kHz	103 dB	136 dB
192 kHz	1.25 kHz	103 dB	133 dB
96 kHz	625 Hz	103 dB	130 dB

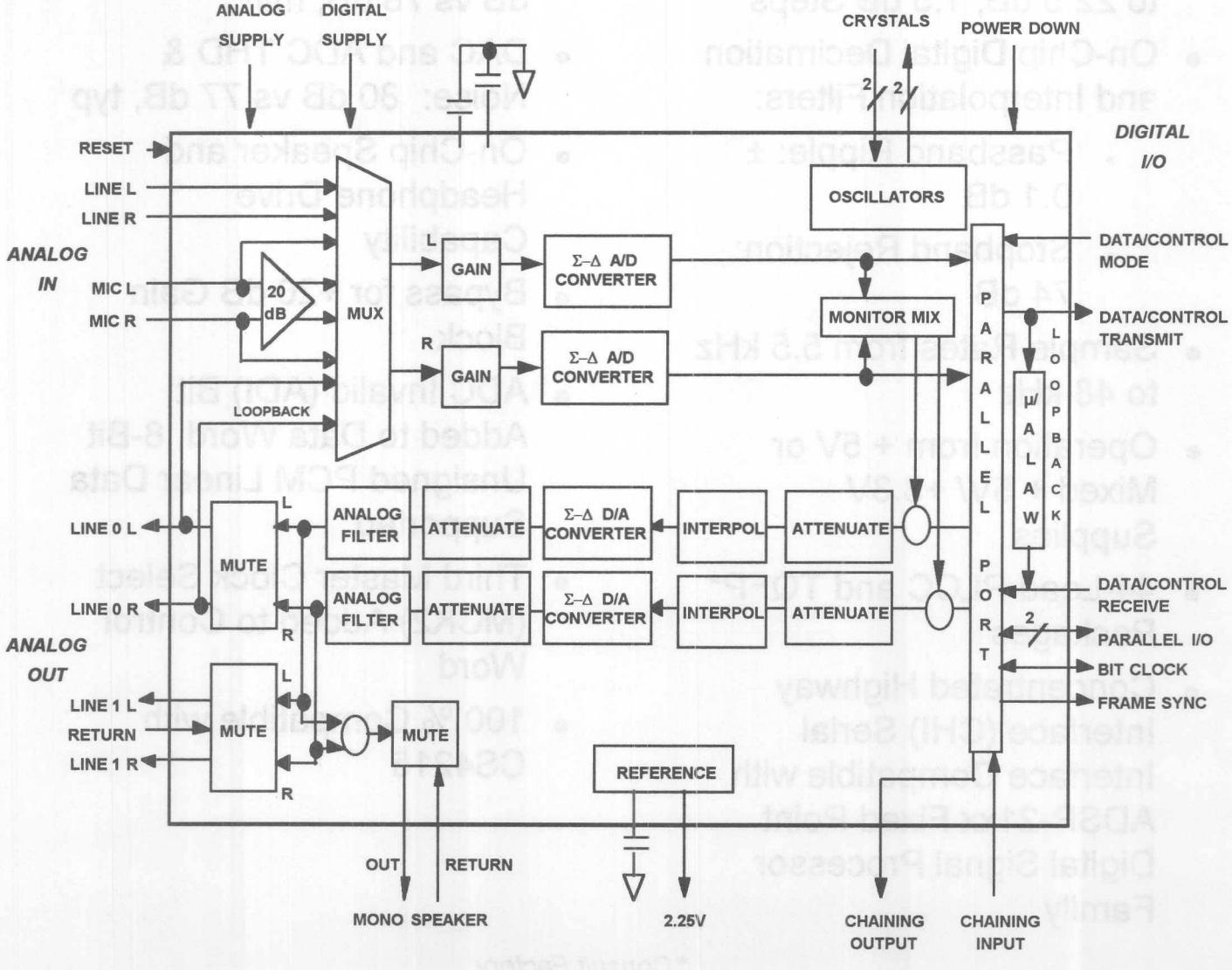
Performance Of The ADMOD79 Running At Various Modulator Clock Rates



Recommended Input Structure

AD1849K
Serial-Port, 16 Bit, SoundPort® Stereo Codec

The AD1849K SoundPort® Stereo Codec integrates key audio data conversion and control functions into a complete, single-chip solution for multimedia applications operating from a single + 5V supply. The AD1849K offers enhanced performance and features over our widely popular AD1849 "J" model.



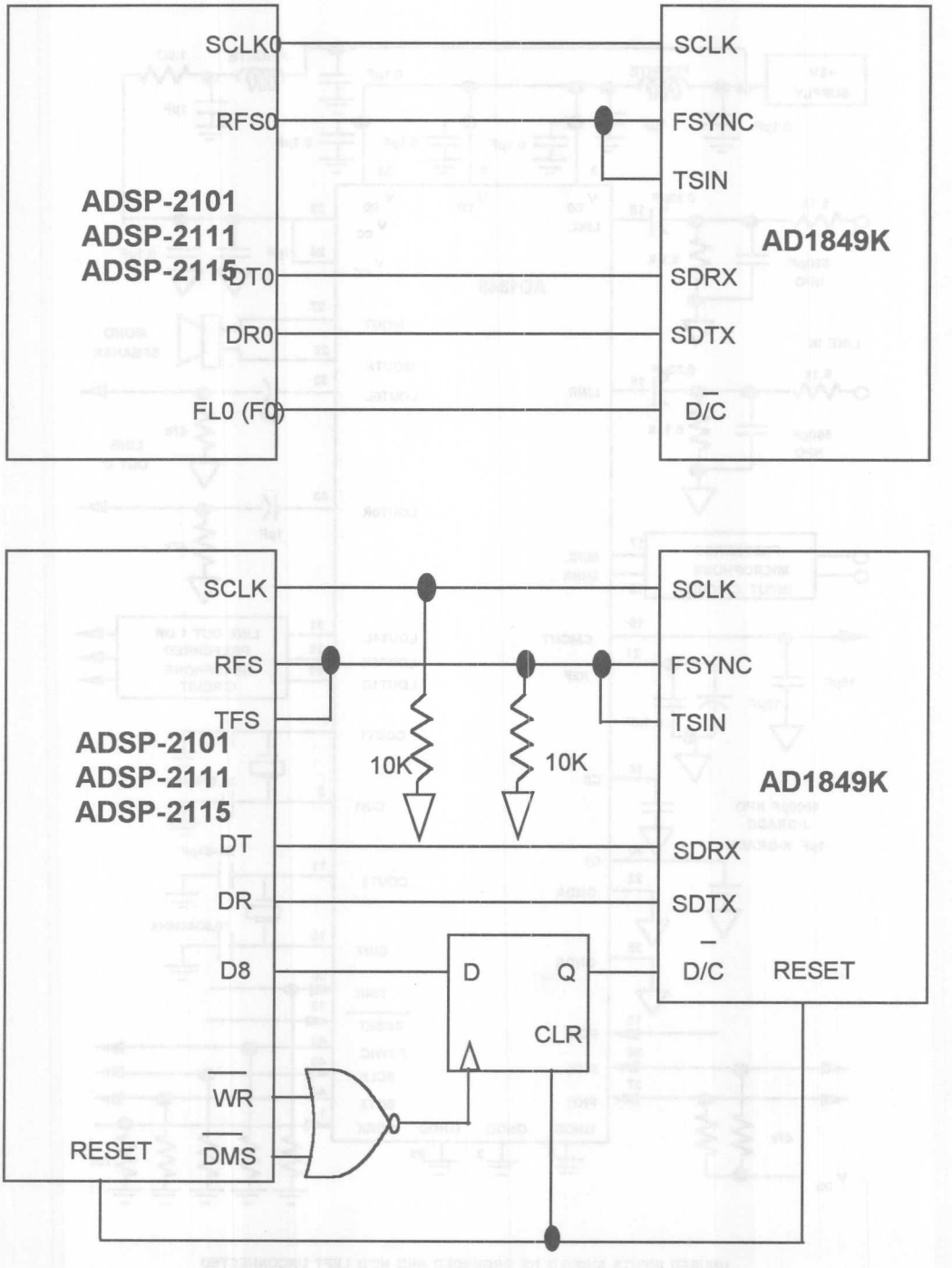
KEY SPECS AND FEATURES:

- Single-Chip, Σ -Δ (Sigma-Delta) Architecture
- A-D Converter PGA: 0 dB to 22.5 dB, 1.5 dB Steps
- On-Chip Digital Decimation and Interpolation Filters:
  - Passband Ripple: ± 0.1 dB
  - Stopband Rejection: 74 dB
- Sample Rates from 5.5 kHz to 48 kHz
- Operation from + 5V or Mixed + 5V/ +3.3V Supplies
- 44-Lead PLCC and TQFP* Packages
- Concentrated Highway Interface (CHI) Serial Interface Compatible with ADSP-21xx Fixed Point Digital Signal Processor Family

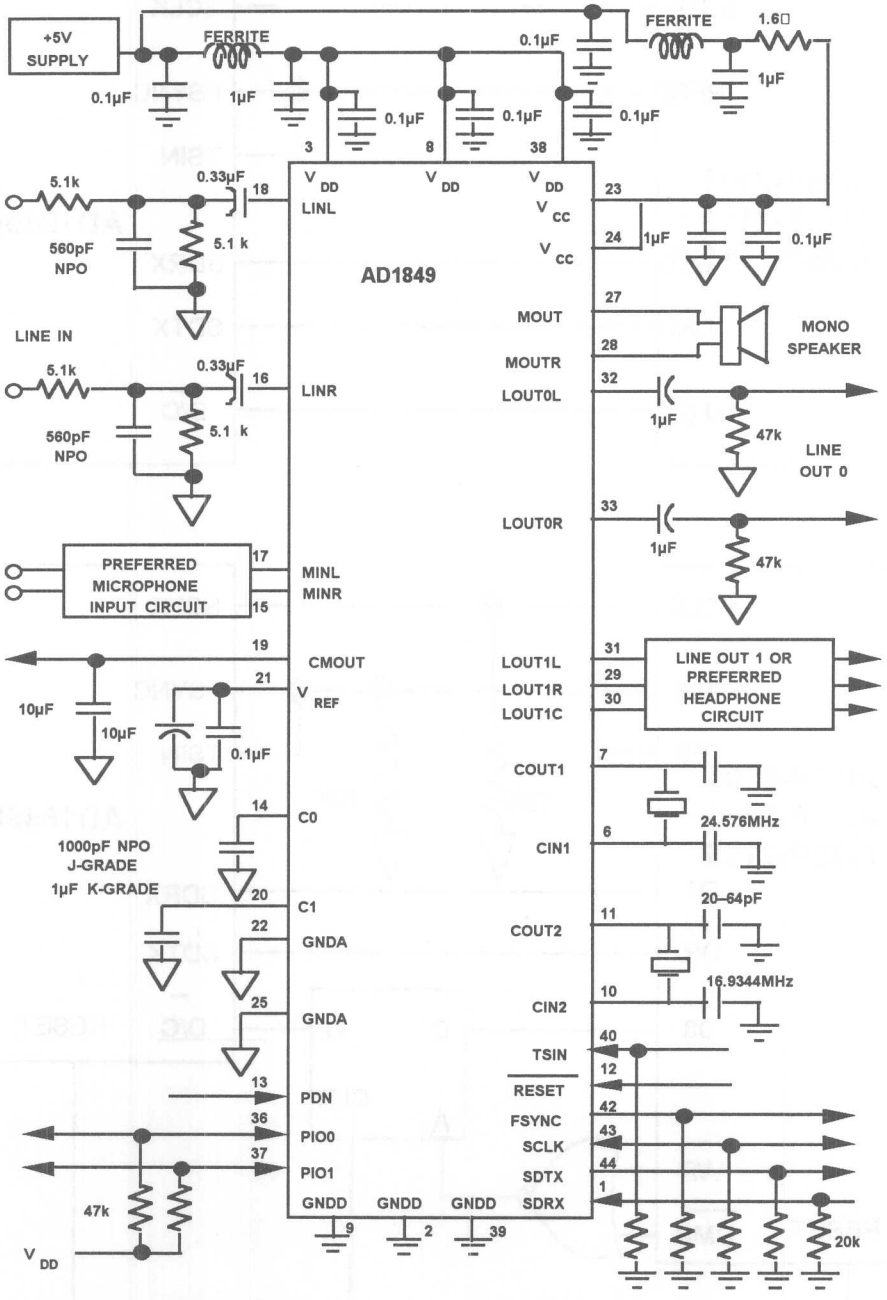
AD1849K ENHANCEMENTS:

- ADC Dynamic Range: 78 dB vs 74 dB, min
- DAC Dynamic Range: 80 dB vs 78 dB, min
- DAC and ADC THD & Noise: 80 dB vs 77 dB, typ
- On-Chip Speaker and Headphone Drive Capability
- Bypass for +20 dB Gain Block
- ADC Invalid (ADI) Bit Added to Data Word, 8-Bit Unsigned PCM Linear Data Supported
- Third Master Clock Select (MCK2) Added to Control Word
- 100 % Compatible with CS4215

** Consult Factory*



Interfacing the AD1849K to Analog Devices' Fixed-Point DSPs

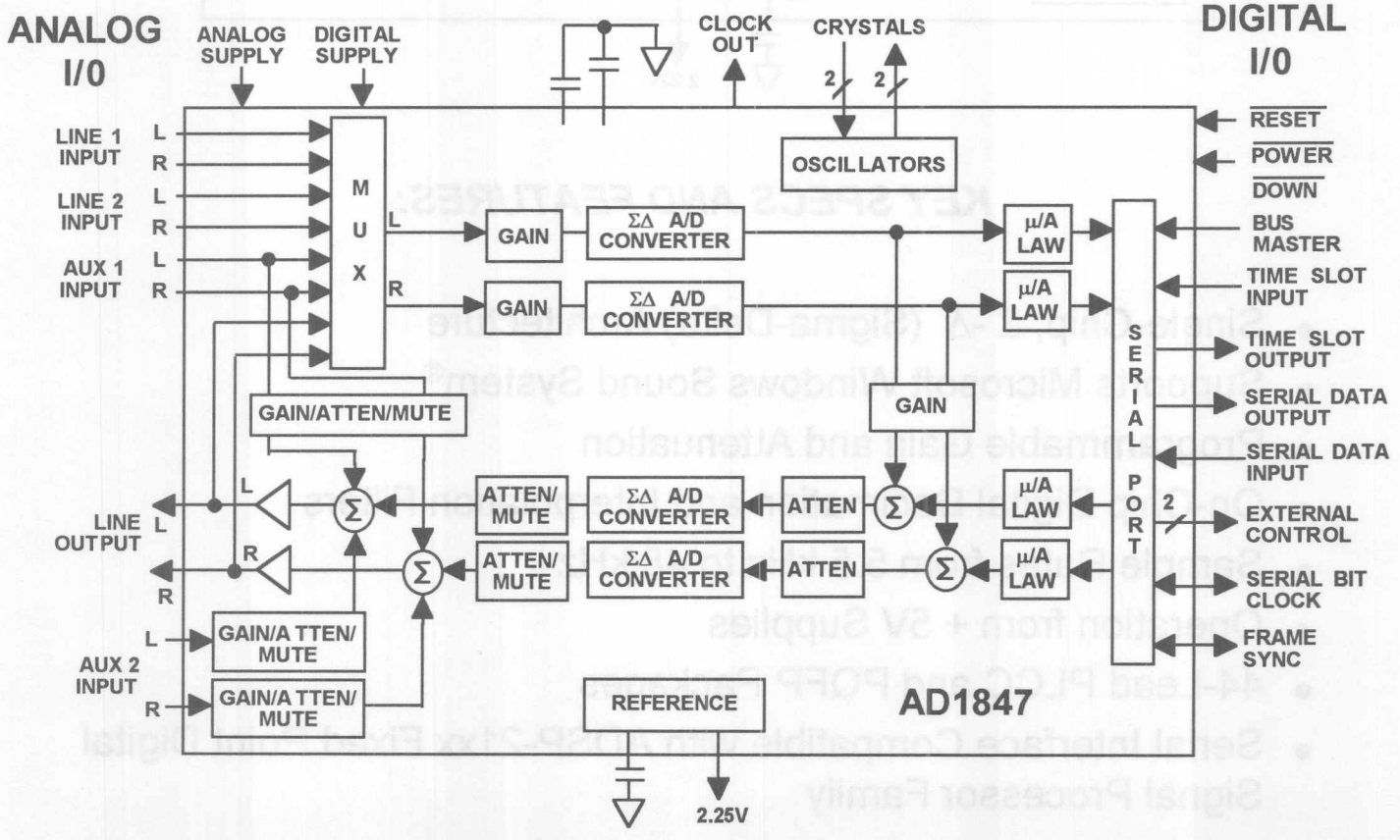


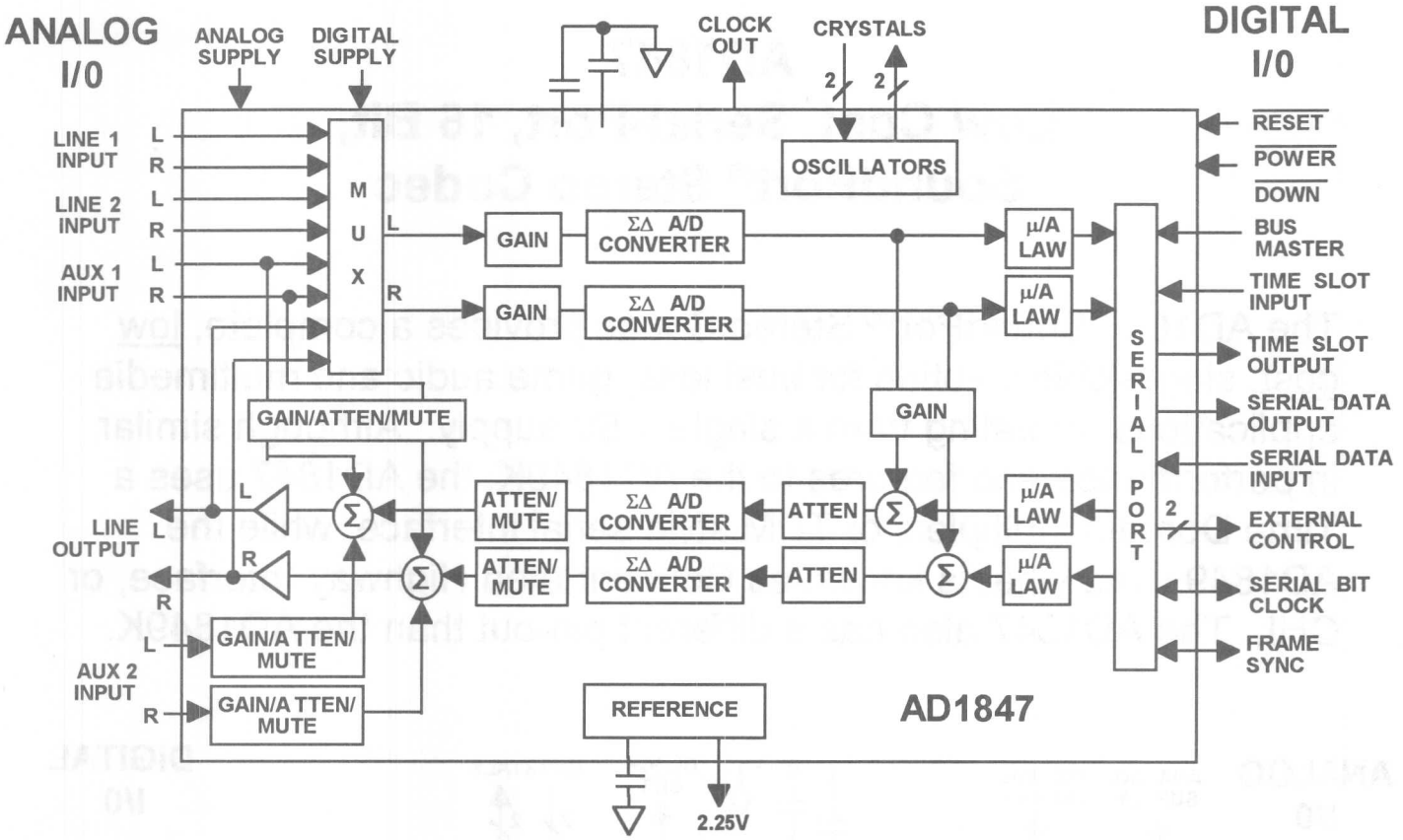
UNUSED INPUTS SHOULD BE GROUNDED AND NC'S LEFT UNCONNECTED

A Typical Connection Diagram for the AD1849K

AD1847
Low Cost, Serial-Port, 16 Bit, SoundPort® Stereo Codec

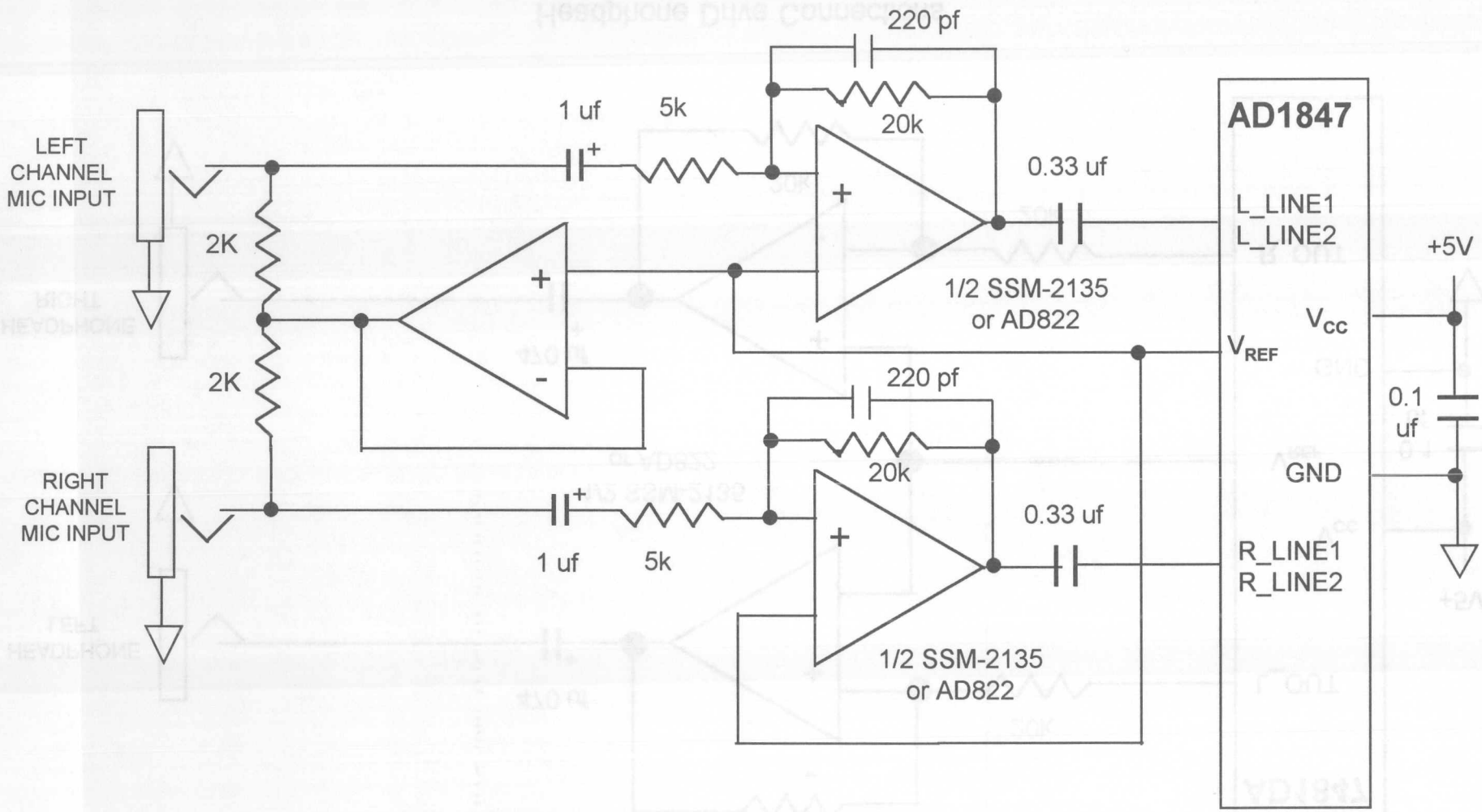
The AD1847 SoundPort® Stereo Codec provides a complete, low cost, single-chip solution for business, game audio and multimedia applications operating from a single + 5V supply. Although similar in performance and features to the AD1849K, the AD1847 uses a Time Domain Multiplex, or TDM style serial interface, while the AD1849 uses what is known as Concentrated Highway Interface, or CHI. The AD1847 also has a different pin-out than the AD1849K.



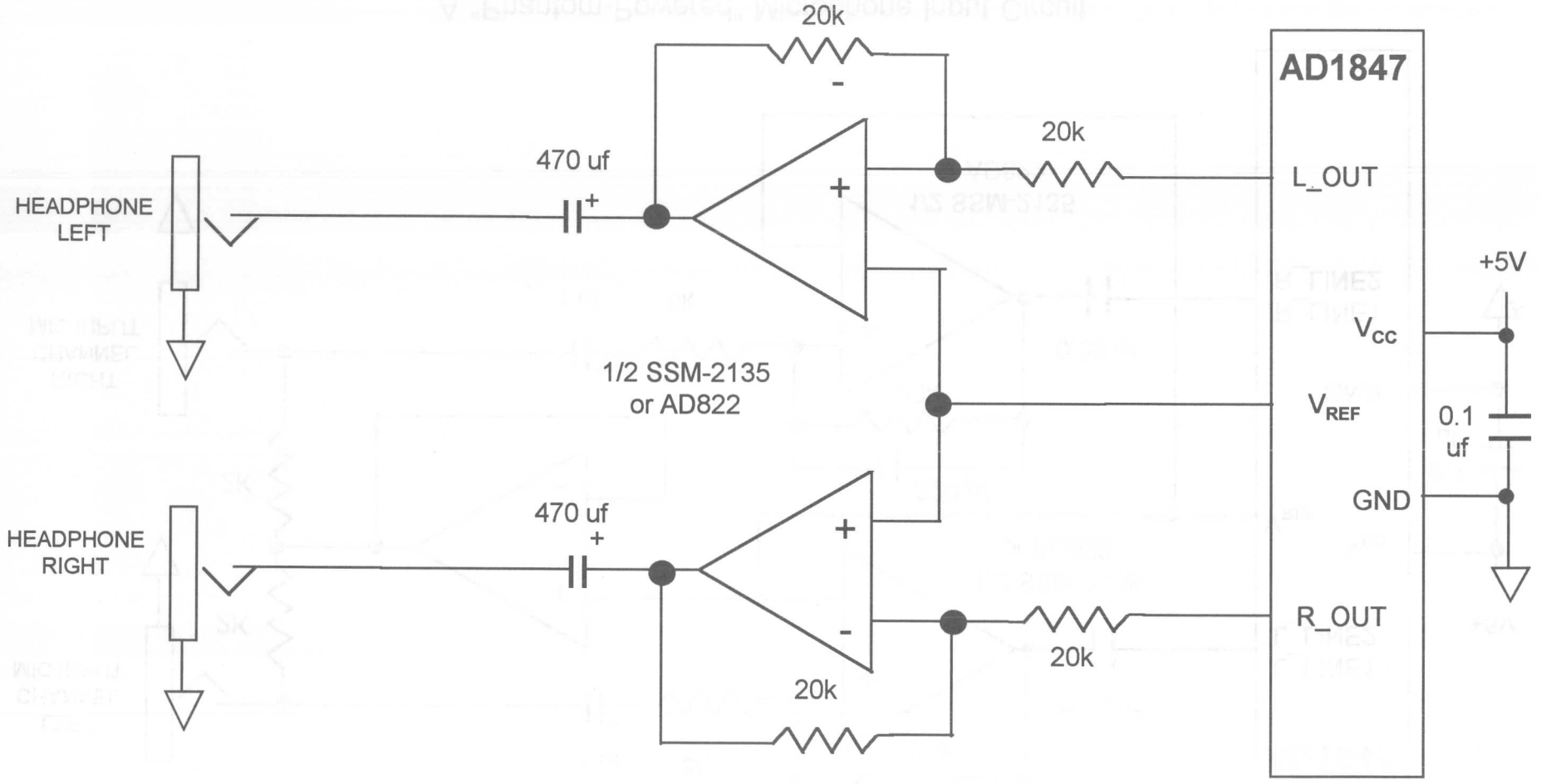


KEY SPECS AND FEATURES:

- Single-Chip, Σ -Δ (Sigma-Delta) Architecture
- Supports Microsoft Windows Sound System®
- Programmable Gain and Attenuation
- On-Chip Digital Decimation and Interpolation Filters
- Sample Rates from 5.5 kHz to 48 kHz
- Operation from + 5V Supplies
- 44-Lead PLCC and PQFP Packages
- Serial Interface Compatible with ADSP-21xx Fixed Point Digital Signal Processor Family



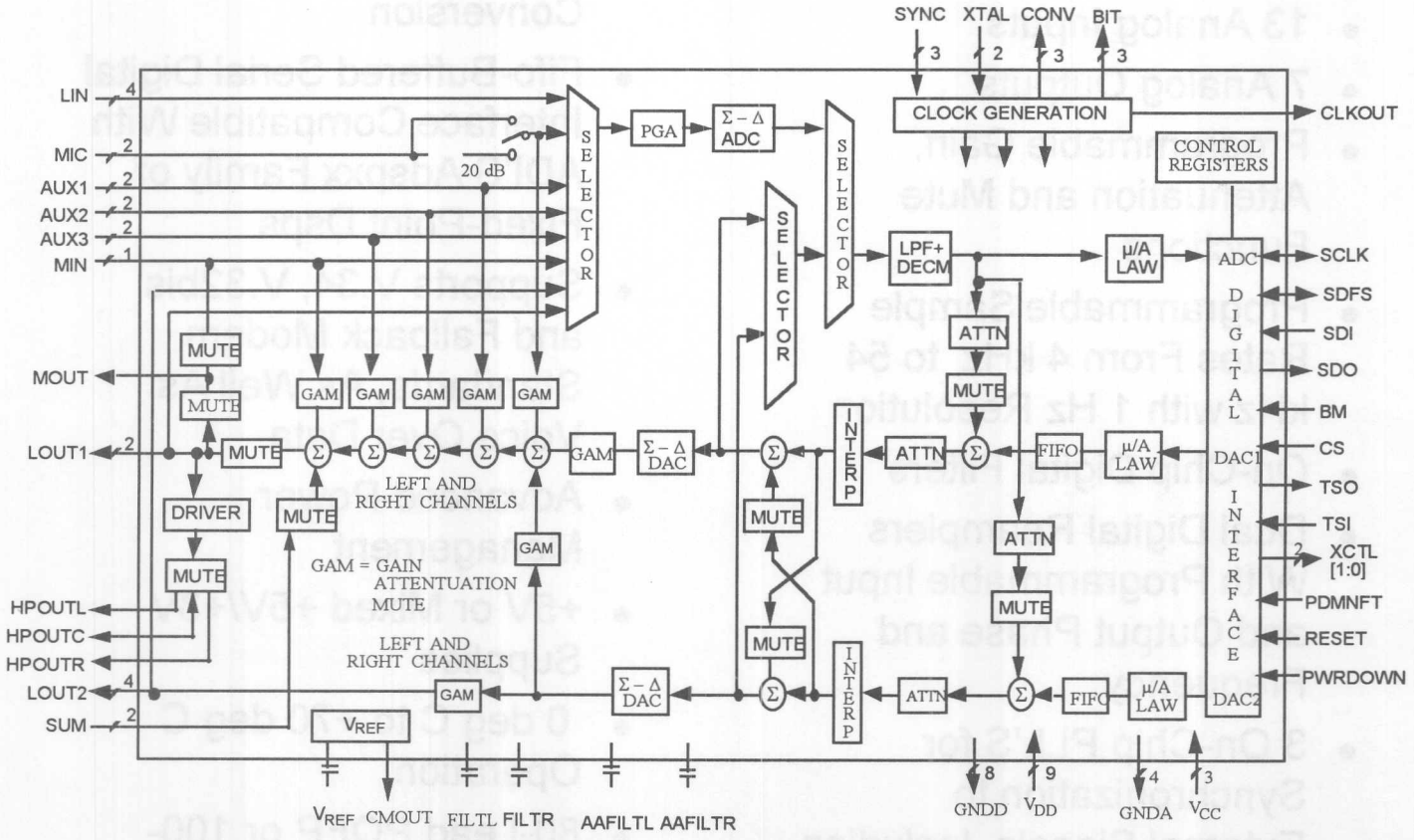
A "Phantom-Powered" Microphone Input Circuit



Headphone Drive Connections

AD1843*
Serial Port, 16-Bit, SoundComm™ Codec

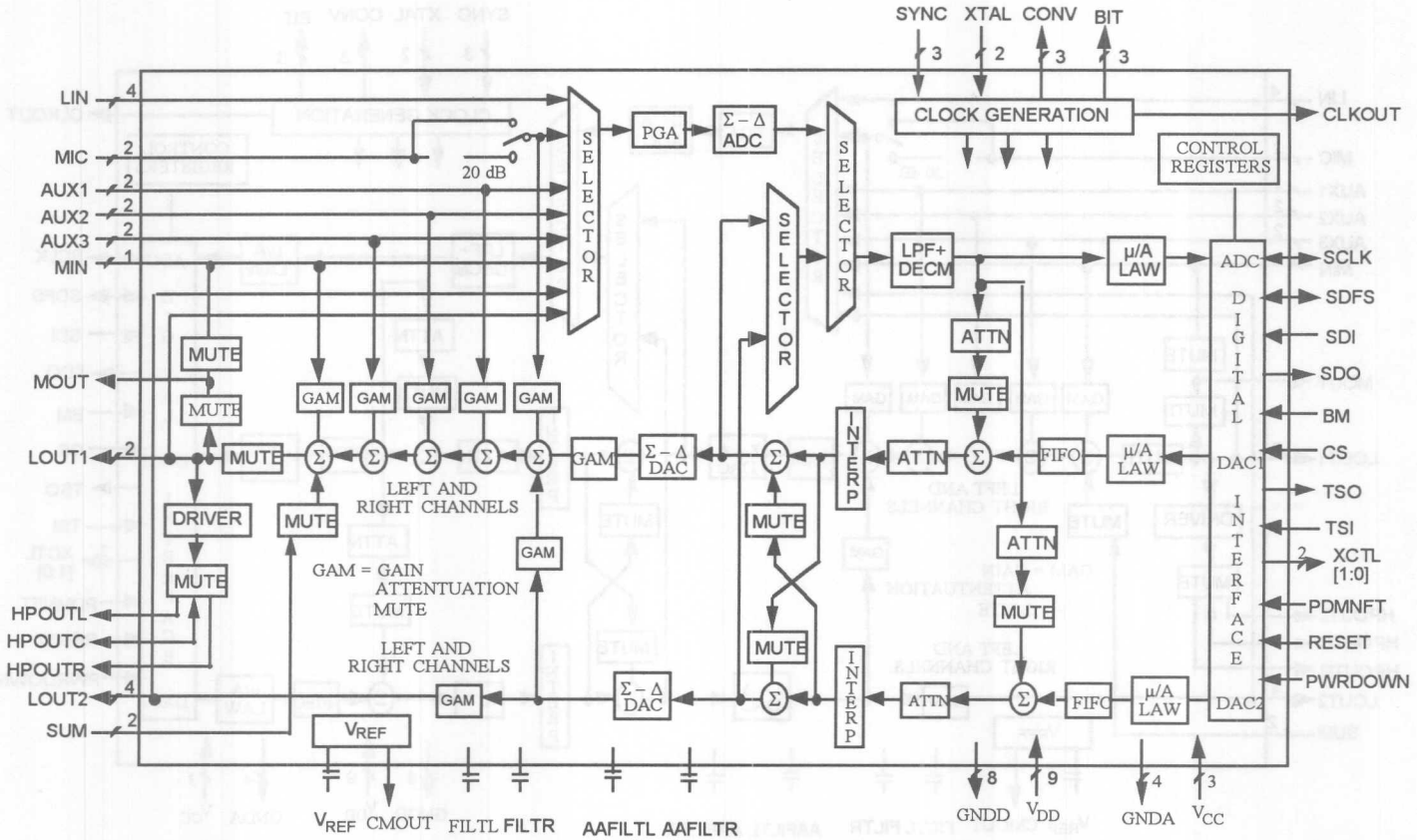
The AD1843 integrates key audio and PSTN data conversion and control functions into a single integrated circuit. The AD1843 provides a complete, single-chip audio, speech and FAX/modem solution for PC multimedia applications.



** Preliminary Technical Information*

KEY SPECS AND FEATURES:

- Single-Chip, Integrated Speech, Audio, FAX and Modem Codec.
- 13 Analog Inputs
- 7 Analog Outputs
- Programmable Gain, Attenuation and Mute Functions
- Programmable Sample Rates From 4 kHz to 54 kHz with 1 Hz Resolution
- On-Chip Digital Filters
- Dual Digital Reamplers With Programmable Input and Output Phase and Frequency
- 3 On-Chip PLL'S for Synchronization to External Signals, Including Video
- Advanced Analog and Digital Signal Muxing and Digital-Digital Sample Rate Conversion
- Fifo-Buffered Serial Digital Interface Compatible With ADI'S Adspxx Family of Fixed-Point Dsps
- Supports V.34, V.32bis and Fallback Modem Standards, As Well As Voice Over Data
- Advanced Power Management
- +5V or Mixed +5V/+3V Supplies
- 0 deg C to +70 deg C Operation
- 80-Lead PQFP or 100-Lead TQFP Packages



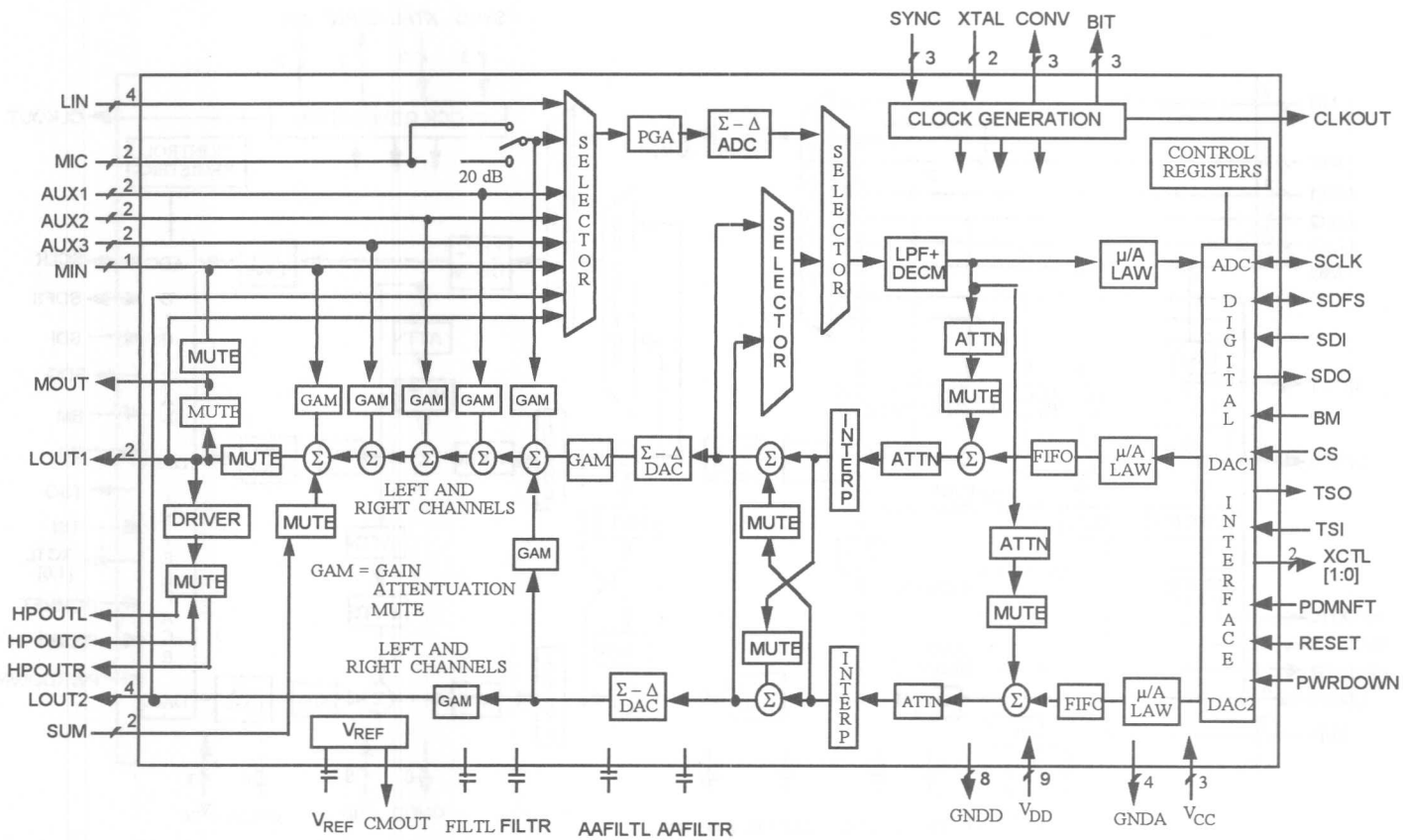
ANALOG INPUT SECTION:

- 2 Channel Σ–Δ A-D Converter
  - » >85 dB Dynamic Range
  - » THD & N > -75 dB
- 13 Analog Inputs**: 1V rms FS Input
- Programmable Gain (PGA) : 22.5 dB, 1.5 dB Steps
- Programmable Attenuator (AUX): 46.5 dB, 1.5 dB Steps
- Mute Function

ANALOG INPUT FUNCTIONS:

Stereo Microphone Pair

- Stereo Line Pair
- Stereo CD Input Pair (AUX 1)
- Stereo Synthesized Music Input Pair (AUX 2)
- Dual Phone Line Input (AUX 3)
- Mono Input
- Stereo Input From FM Synthesizer



DIGITAL INTERPOLATION AND DECIMATION FILTERS:

- Audio, Modem and Resampling Modes
- Passband : 0.4 F_s
- Passband Ripple : $\pm$ 0.1 dB
- Stopband : 0.6 F_s
- Stopband Rejection :
  - » > 90 dB, Audio/Resampling Modes
  - » > 75 dB, Modem Mode

ANALOG OUTPUT SECTION:

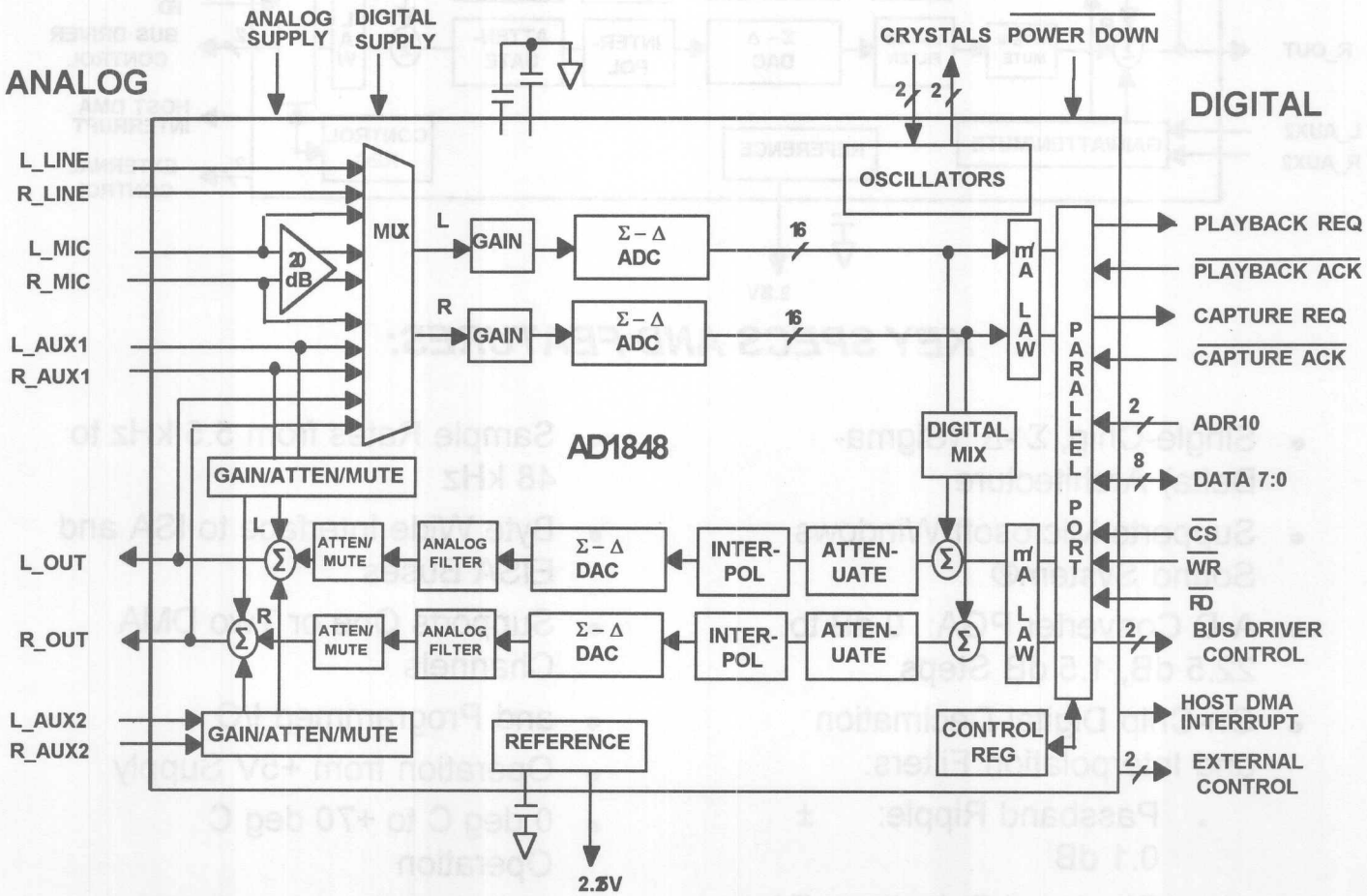
- Quad $\Sigma - \Delta$ D-A Converter
  - » > 80 dB Dynamic Range
  - » THD & N : > -75 dB
- 7 Analog Outputs** : 0.707V rms FS
- DAC Attenuators :
  - » 82.5 dB, 1.5 dB Steps

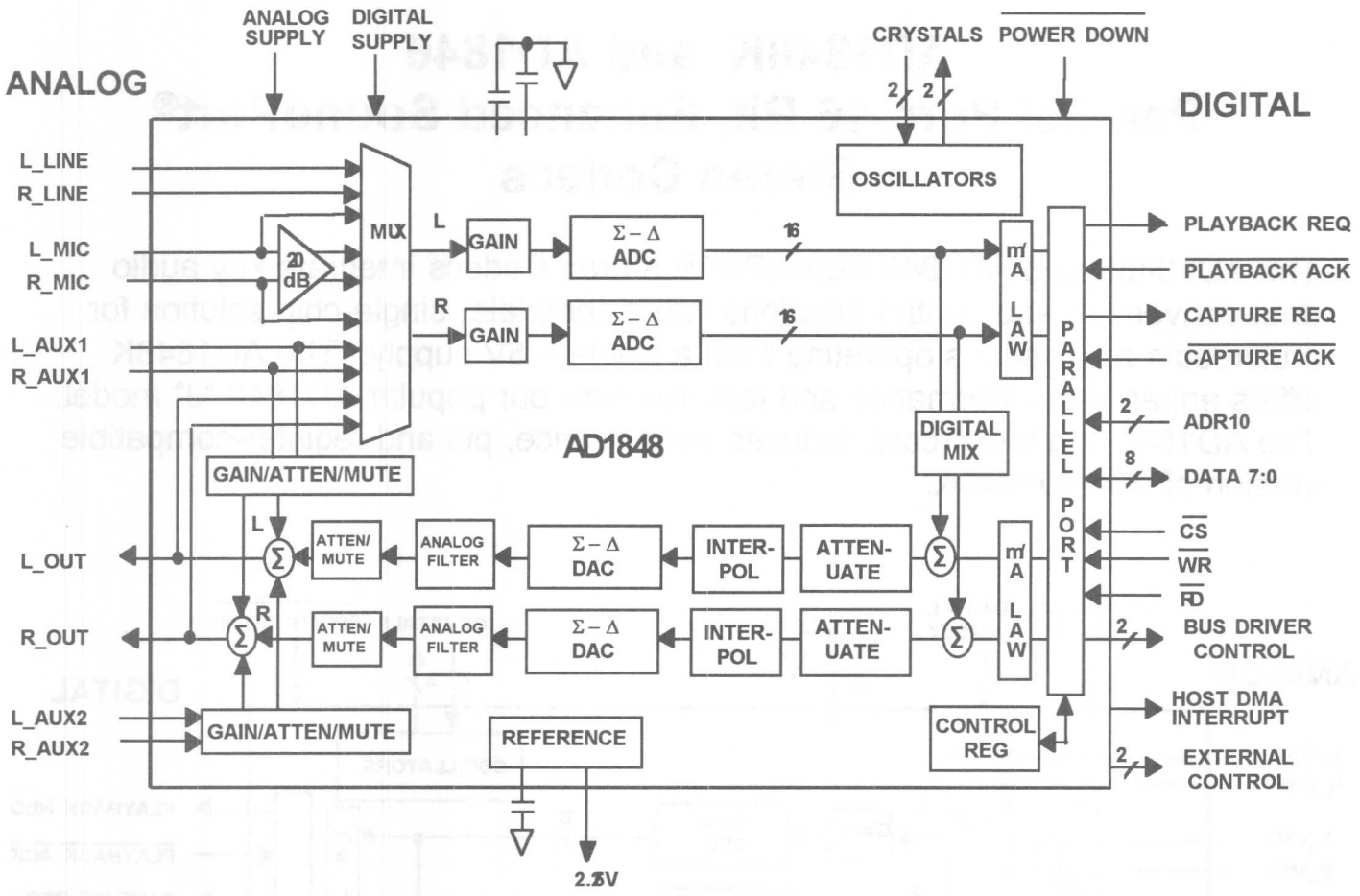
ANALOG OUTPUT FUNCTIONS:

- Line Output
- Mono Output
- Stereo Headphone Output
- Differential Stereo Output for DAA

AD1848K and AD1846 Parallel-Port, 16 Bit, Enhanced SoundPort® Stereo Codecs

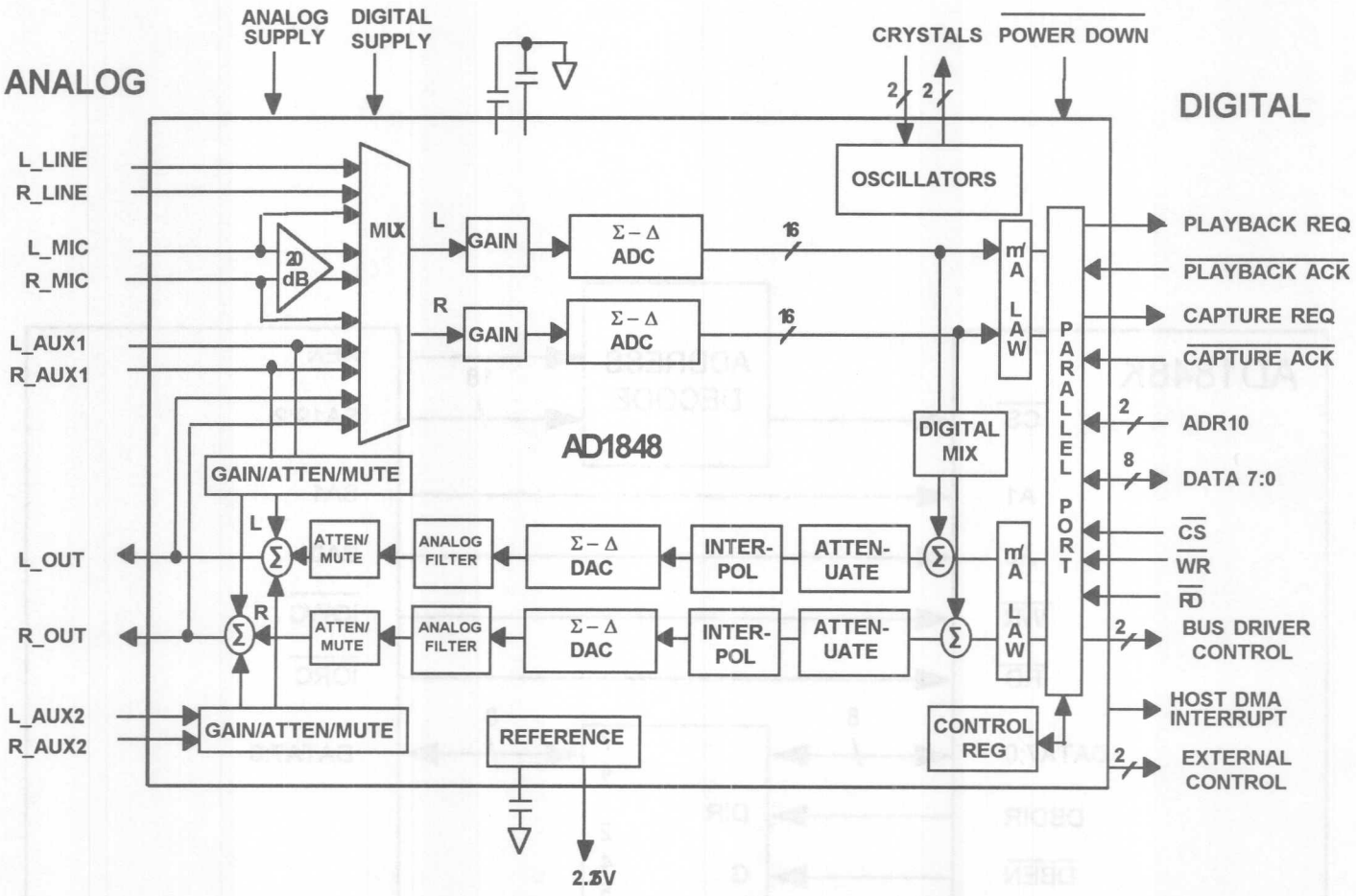
The AD1848K and AD1846 SoundPort® Stereo Codecs integrate key audio data conversion and control functions into a complete, single-chip solution for multimedia applications operating from a single + 5V supply. The AD1848K offers enhanced performance and features over our popular AD1848 "J" model. The AD1846 is a lower cost, reduced performance, pin and register-compatible version of our AD1848K.





KEY SPECS AND FEATURES:

- Single-Chip, Σ -Δ (Sigma-Delta) Architecture
- Supports Microsoft Windows Sound System®
- A-D Converter PGA: 0 dB to 22.5 dB, 1.5 dB Steps
- On-Chip Digital Decimation and Interpolation Filters:
  - Passband Ripple: ± 0.1 dB
  - Stopband Rejection: 74 dB
- Sample Rates from 5.5 kHz to 48 kHz
- Byte Wide Interface to ISA and EISA Buses
- Supports One or Two DMA Channels
- and Programmed I/O
- Operation from +5V Supply
- 0 deg C to +70 deg C Operation
- 68 Lead PLCC and PQFP Packages

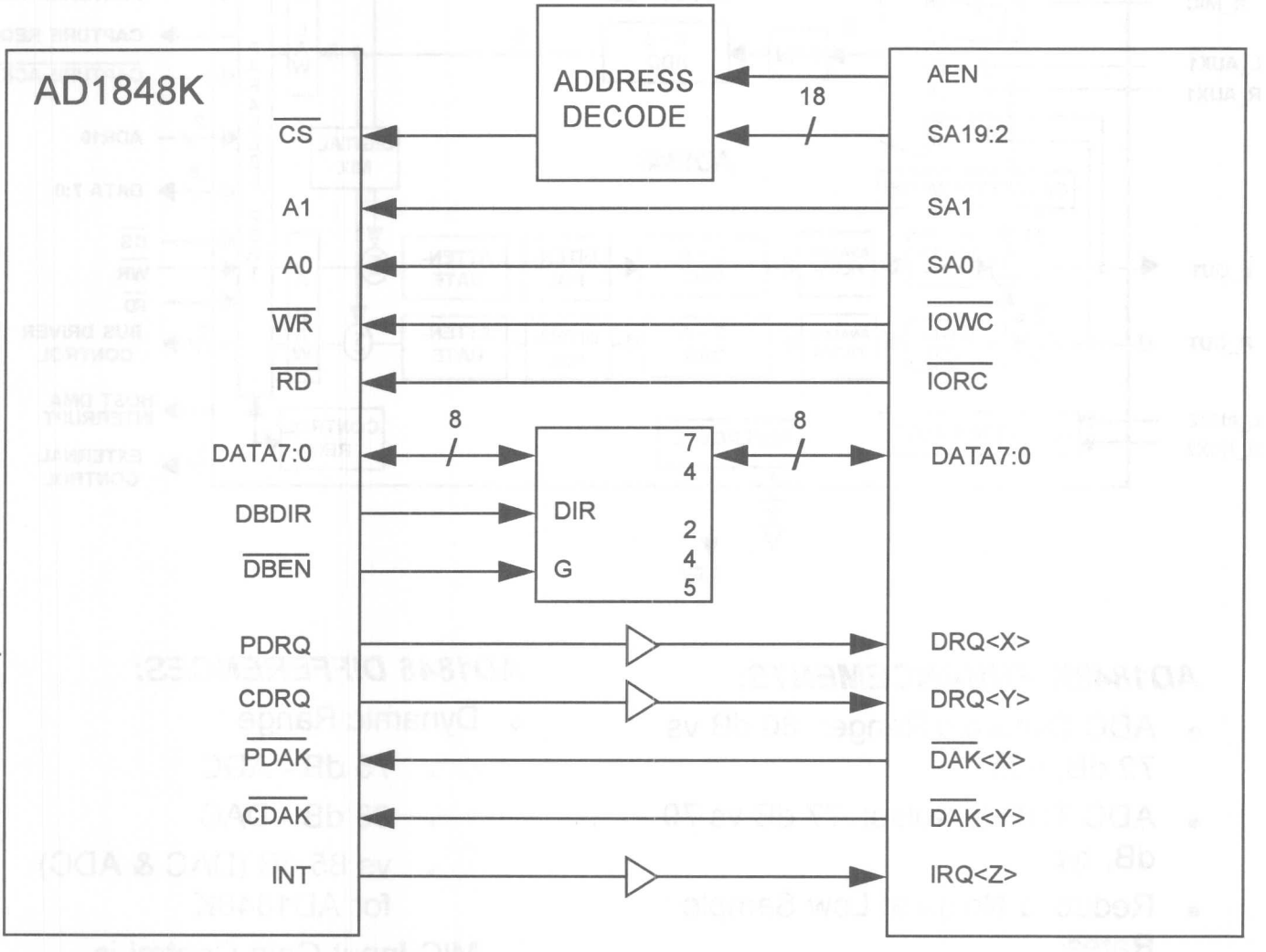


AD1848K ENHANCEMENTS:

- ADC Dynamic Range: 80 dB vs 72 dB, min
- ADC THD & Noise: 77 dB vs 70 dB, typ
- Reduced Noise at Low Sample Rates
- Reduced "Pops" and "Clicks"
- Reduced Offset at High PGA Gains
- Auxiliary Input Attenuation Steps Doubled
- Auxiliary Input Gain Added

AD1846 DIFFERENCES:

- Dynamic Range :
  - 75 dB - ADC
  - 83 dB - DAC
  - vs 85 dB (DAC & ADC) for AD1848K
- MIC Input Gain Control is Digital vs Analog
- AD1846 Returns Same Hardware Revision ID Number (1010) as AD1848



A Typical Interface to the ISA Bus

SECTION 7
MONOLITHIC SENSOR PRODUCTS

Temperature Sensors

Programmable Temperature Controller

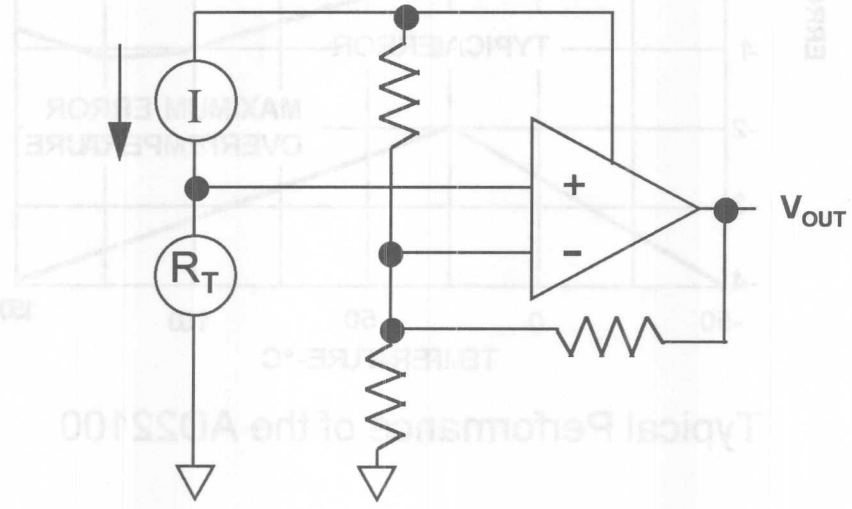
Temperature Sensors w/Serial Digital Output

Silicon Thermostats

High Sensitivity Hall Effect Sensor

AD22100 and AD22103
Monolithic Temperature Sensors

The AD22100 and AD22103 are low cost, single supply temperature sensor ICs whose output voltages are directly proprtional to temperature.

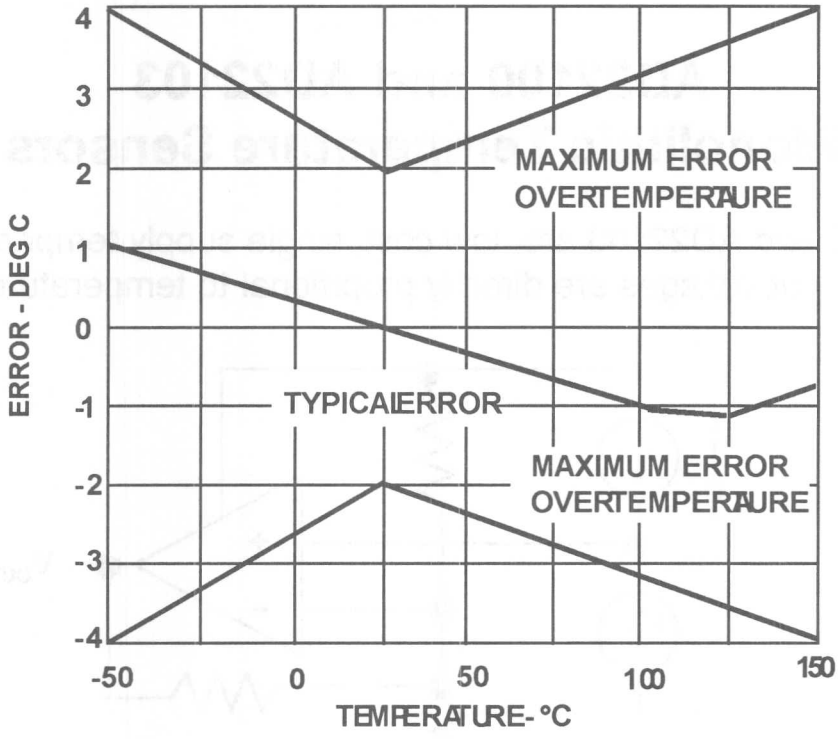


$$\text{AD22100}: \quad V_{OUT} = \frac{V+}{5V} \times [\, 1.375V + (22.5\ mV/deg\ C \times T_{AMB})]$$

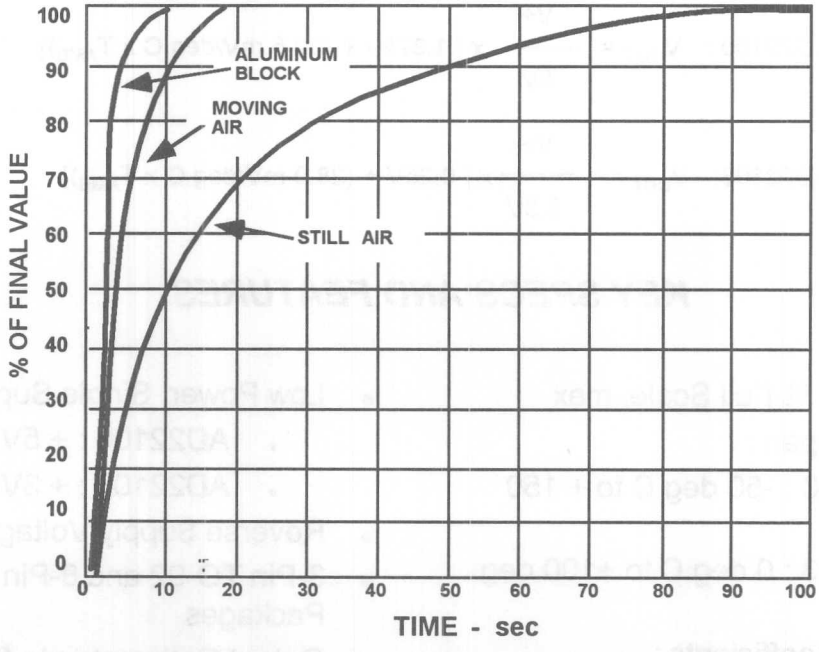
$$\text{AD22103}: \quad V_{OUT} = \frac{V+}{3.3V} \times [\, 0.25V + (28.0\ mV/deg\ C \times T_{AMB})]$$

KEY SPECS AND FEATURES:

- Accuracy ± 2.0 % Full Scale, max
- Temperature Span :
  - AD22100 : -50 deg C to + 150 deg C
  - AD22103 : 0 deg C to +100 deg C
- Temperature Coefficients :
  - AD22100 : 22.5 mV/deg C
  - AD22103 : 28.0 mV/deg C
- Low Power, Single Supply Operation:
  - AD22100 : + 5V @ 650 uA max
  - AD22103 : + 3V @ 600 uA max
- Reverse Supply Voltage Protection
- 3-Pin TO-92 and 8-Pin SOIC Packages
- Output Ratiometric to Supply Voltage



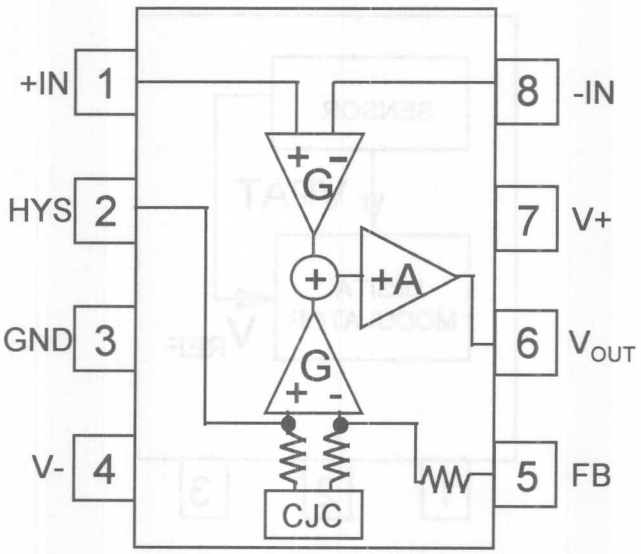
Typical Performance of the AD22100



Response Time of the AD22100 for Various Mediums

AD597AN
Thermocouple Conditioner/Set Point Controller

The AD597AN is our popular AD597 offered in a lower cost, 8-pin, plastic DIP package.

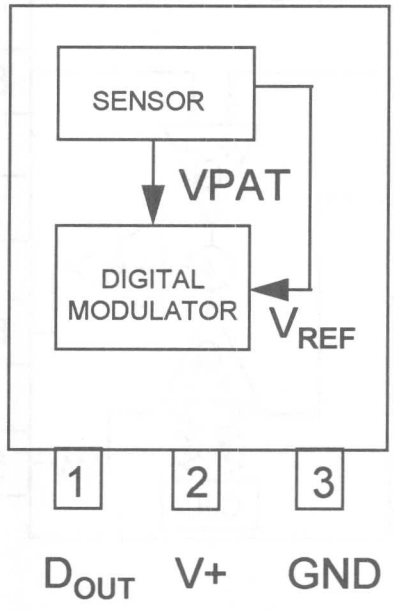


KEY SPECS AND FEATURES:

- New Low er Cost Plastic Package:
  - ~ $ 3.00 in 1,000's
- Calibrated for Type K Thermocouples
  - ± 4 deg C Accuracy
- Temperature Proportional Output:
  - 250 mV @ +25 deg C
  - 10 mV/deg C
- Built-In Ice Point Compensation (CJC)
- Stand Alone Temperature Monitor
- Set Point Controller
- Wide Power Supply Range:
  - + 5V to + 36V
  - ± 2.5V to ±18V

TMP03/TMP03L
Micropower Temperature Sensors w/Serial Digital Outputs

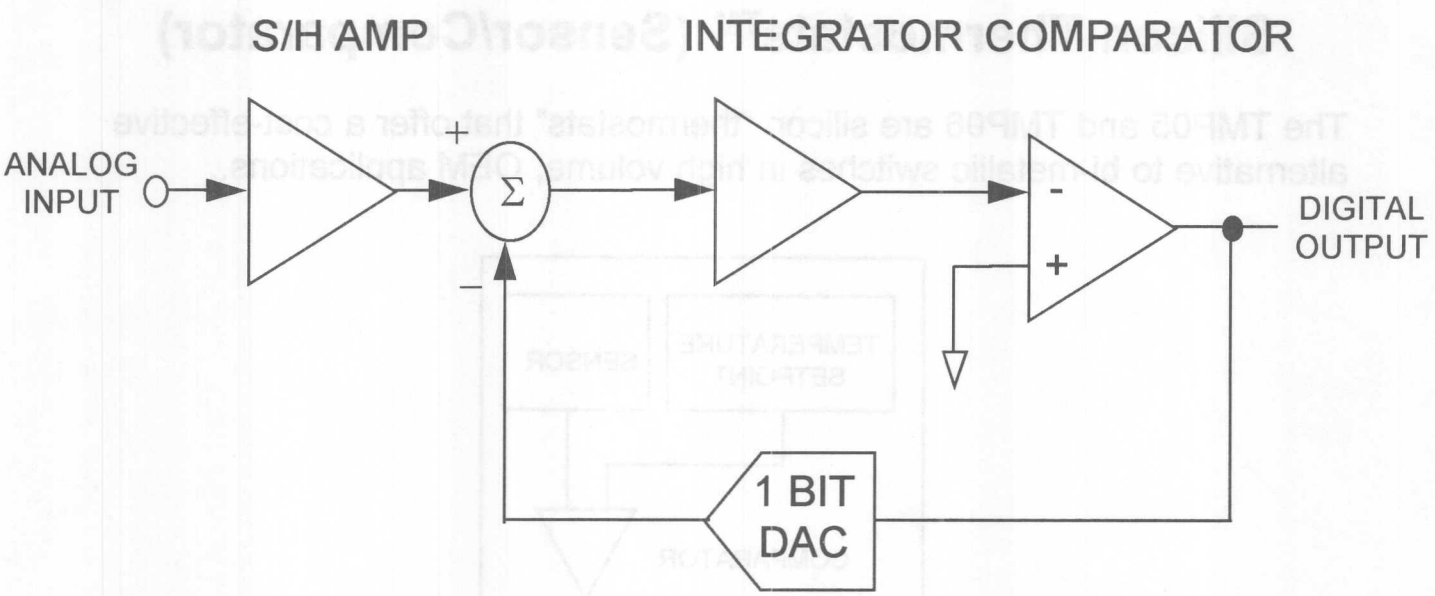
The TMP03 and TMP03L are very low cost temperature sensors that produce an accurate, serial digital output whose duty cycle is proportional to temperature.



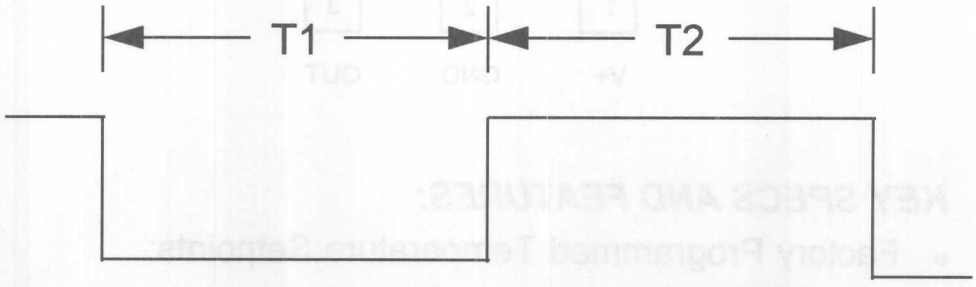
KEY SPECS AND FEATURES:

- High Accuracy, 1st Order Sigma-Delta Modulator
  - » ± 1.2 deg C Max Accuracy over Temperature ("E" Grade)
- Low Power Operation:
  - » 4.5V to 7.0V
  - » Only 3.5 mW @ 5V
- No External Components Required
- Choice of Logic Outputs:
  - » TMP03 : Open Collector
    TMP03L : CMOS/TTL
- Package Styles:
  - » 3-Pin TO-92
  - » 8-Pin SOIC and TSSOP

**Preliminary Technical Information*



A 1st Order Sigma Delta Modulator

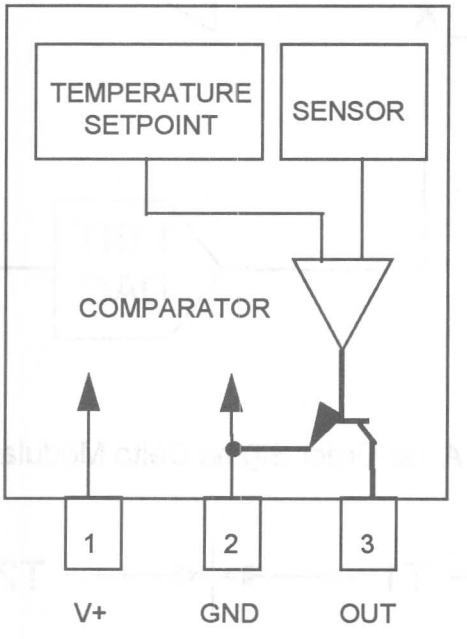


$$Temp = 260 - \frac{(450 \times T1)}{T2} \text{ ; deg C}$$

Serial Digital Output Format

TMP05/TMP06
Silicon Thermostats™ (Sensor/Comparator)

The TMP05 and TMP06 are silicon "thermostats" that offer a cost-effective alternative to bi-metallic switches in high volume, OEM applications..



KEY SPECS AND FEATURES:

- Factory Programmed Temperature Setpoints:
  - TMP05 : Overtemp = ON
  - TMP06 : Undertemp = ON
- No User Calibration Required
- ± 1 deg C Setpoint Accuracy
- Wide Power Supply Range : 2.5V to 30V
- Low Power : 125 uW max @ +5V
- Flexible, Open-Collector Output
- -40 deg C to +100 deg C Operation

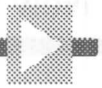
* *Preliminary Technical Information*

SECTION 8
COMMUNICATIONS PRODUCTS

Differential Output Transimpedance Amplifier

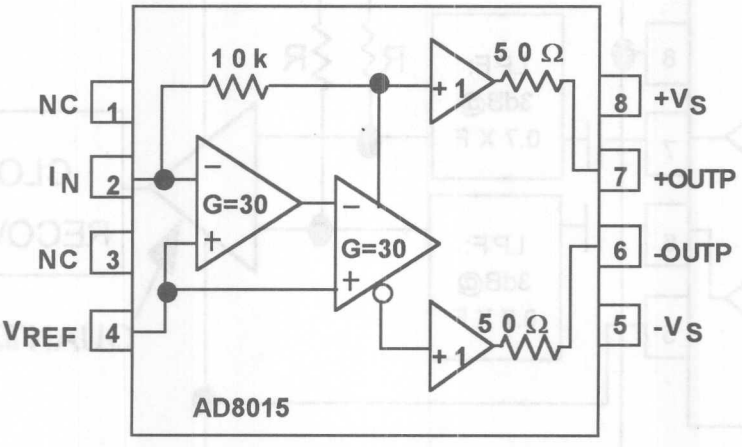
Low Distortion RF Mixer

Low Power Mixer/Receiver IF Subsystems



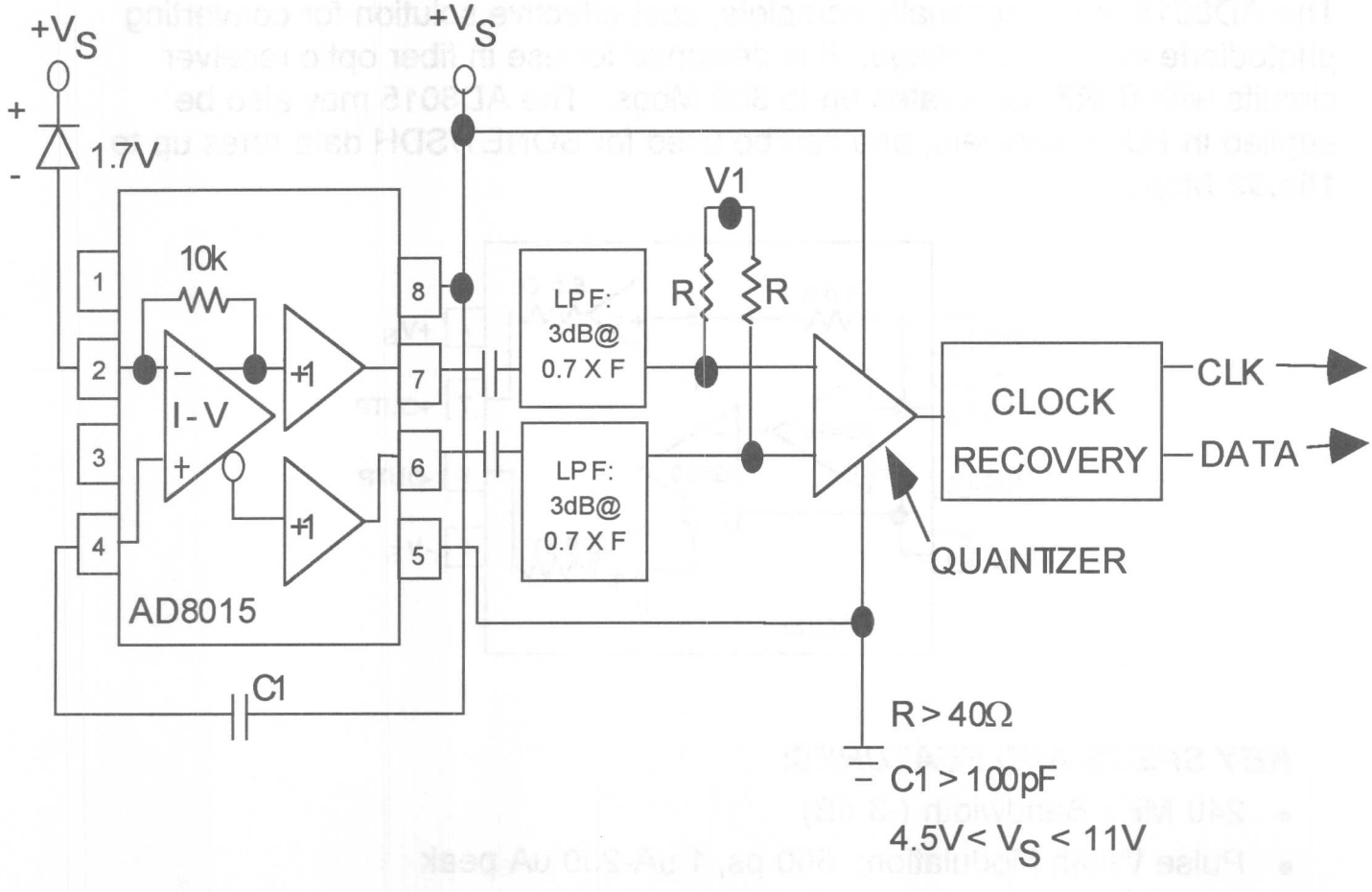
AD8015
200 MHz, Differential Output, Transimpedance Amplifier

The AD8015 is a functionally complete, cost-effective solution for converting photodiode current to voltage. It is designed for use in fiber optic receiver circuits with (NRZ) data rates up to 300 Mbps. The AD8015 may also be applied in FDDI receivers, and can be used for SONET/SDH data rates up to 155.52 Mbps.

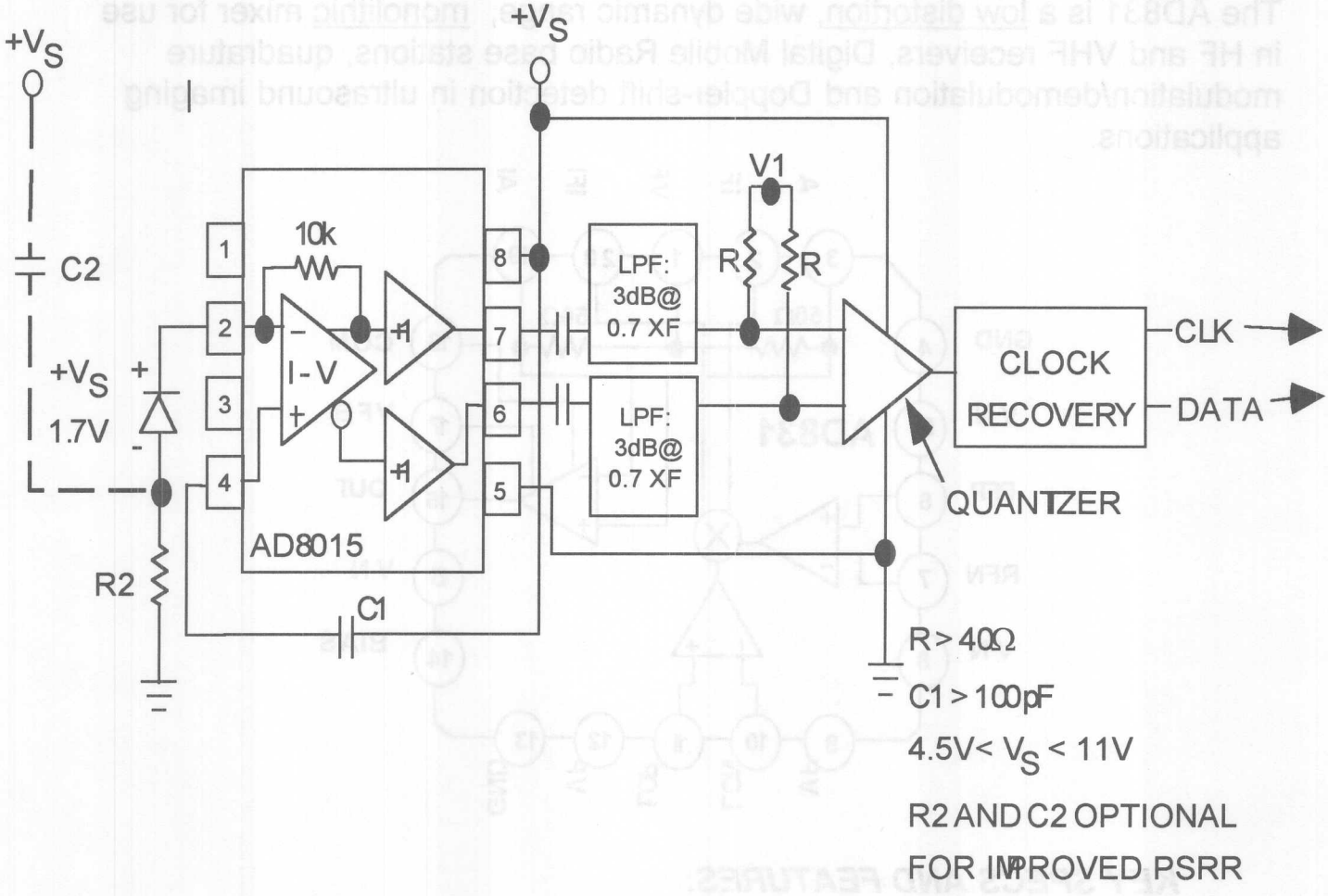


***KEY SPECS AND FEATURES*:**

- 240 MHz Bandwidth (-3 dB)
- Pulse Width Modulation: 500 ps, 1 uA-200 uA peak
- Rise and Fall Times typ 1.5 ns
- Low Input Current Noise: 2.0 pA/√ Hz @ 100 MHz
- Total Integrated RMS Noise: 20 nA to 100 MHz
- Optical Sensitivity: -36 dBm @ 155.52 Mbps
- ± 350 uA Peak Input Currents
- Single Supply, Low Power Operation : +5V @ 125 mW
- -40 deg C to +85 deg C Operation



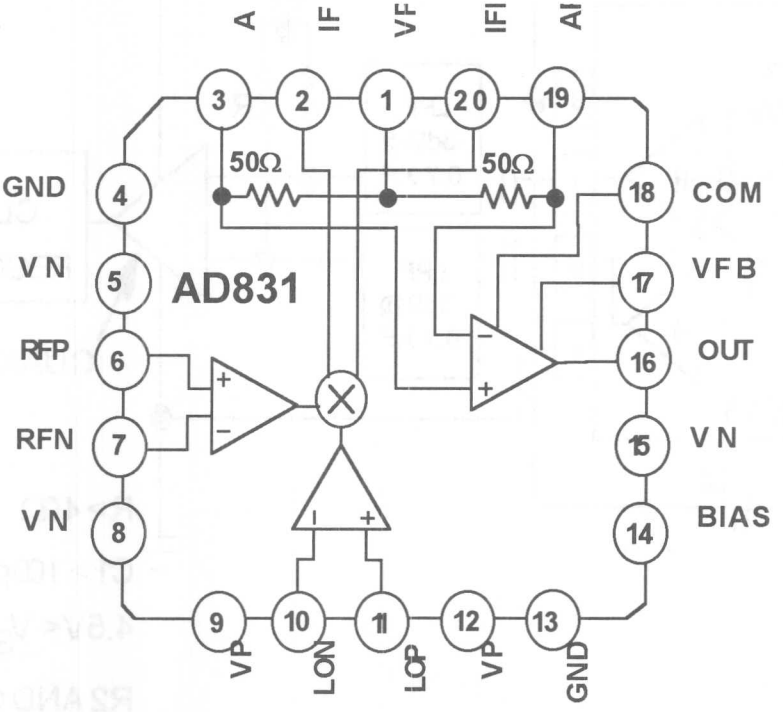
The AD8015 is shown being used in a typical fiber optic receiver circuit to convert the photodiode current to a voltage. In this circuit, the photodiode is referenced to a positive rather than negative supply for two reasons: (1) improved power supply noise immunity (PSRR); (2) photodiode capacitance not modulated by high frequency noise that may exist on the negative supply rail.



In this circuit, the photodiode is referenced to the negative supply. This results in a larger back-bias on the photodiode, which reduces its capacitance and increases its frequency.

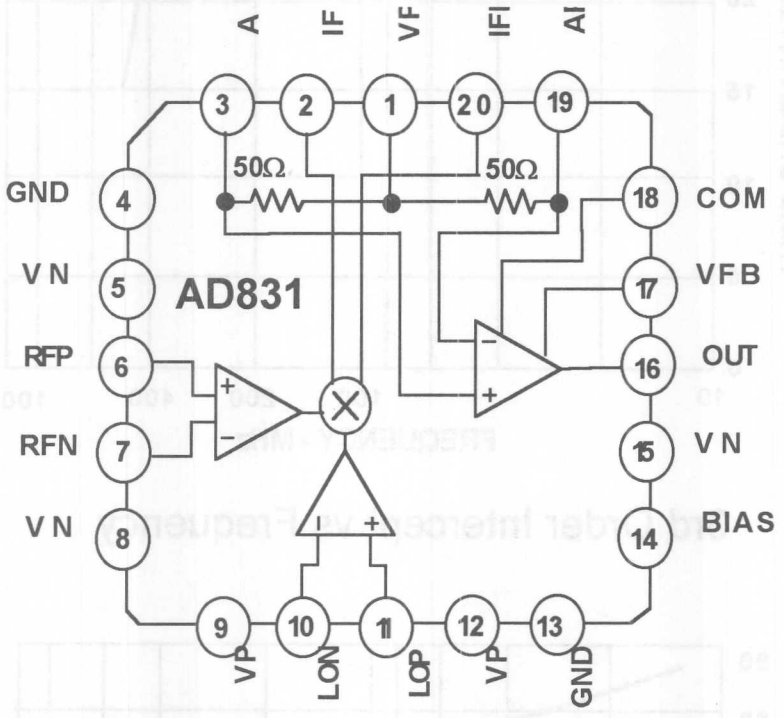
AD831
500 MHz, Low Distortion RF Mixer

The AD831 is a low distortion, wide dynamic range, monolithic mixer for use in HF and VHF receivers, Digital Mobile Radio base stations, quadrature modulation/demodulation and Doppler-shift detection in ultrasound imaging applications.



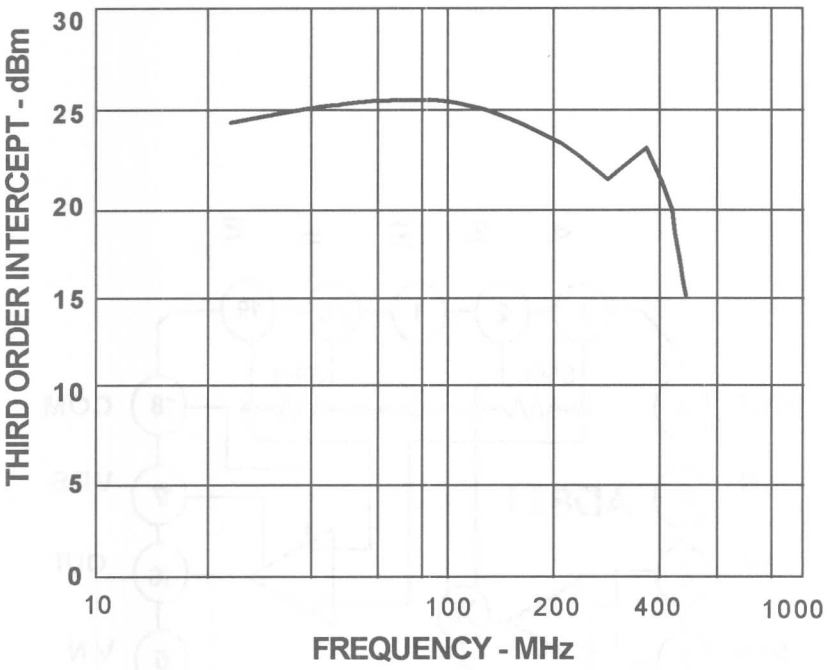
KEY SPECS AND FEATURES:

- Low Distortion/Noise Performance:
  - + 24 dBm Third Order Intercept (IP3)
  - + 10 dBm 1 dB Compression Point
  - 20 dB SSB Noise Figure
- Low Local Oscillator (LO) Drive Required: Only - 10 dBm
- Wide Dynamic Range:
  - 500 MHz RF and LO Inputs
  - 250 MHz Differential Current IF Output
  - DC to > 200 MHz Single-Ended Voltage IF Output

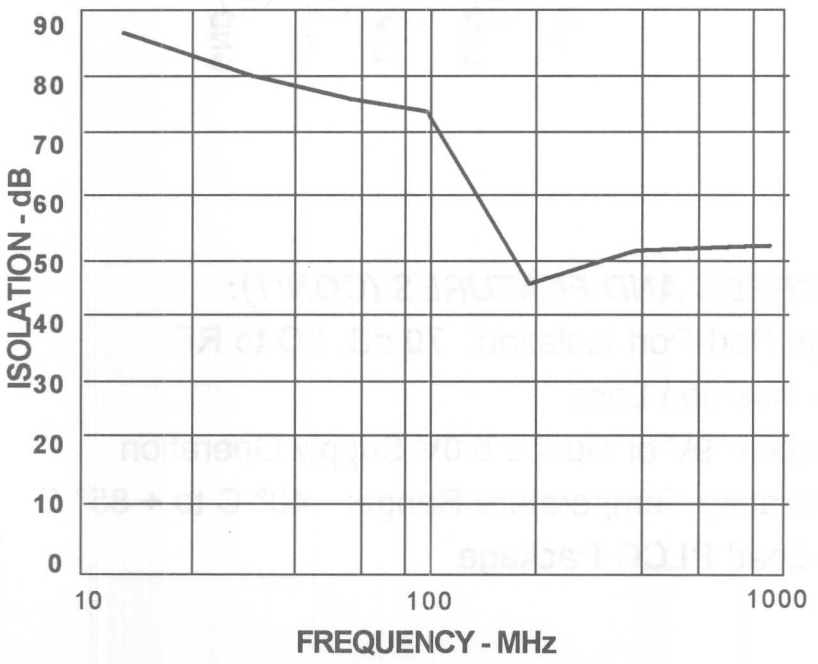


KEY SPECS AND FEATURES (CON'T):

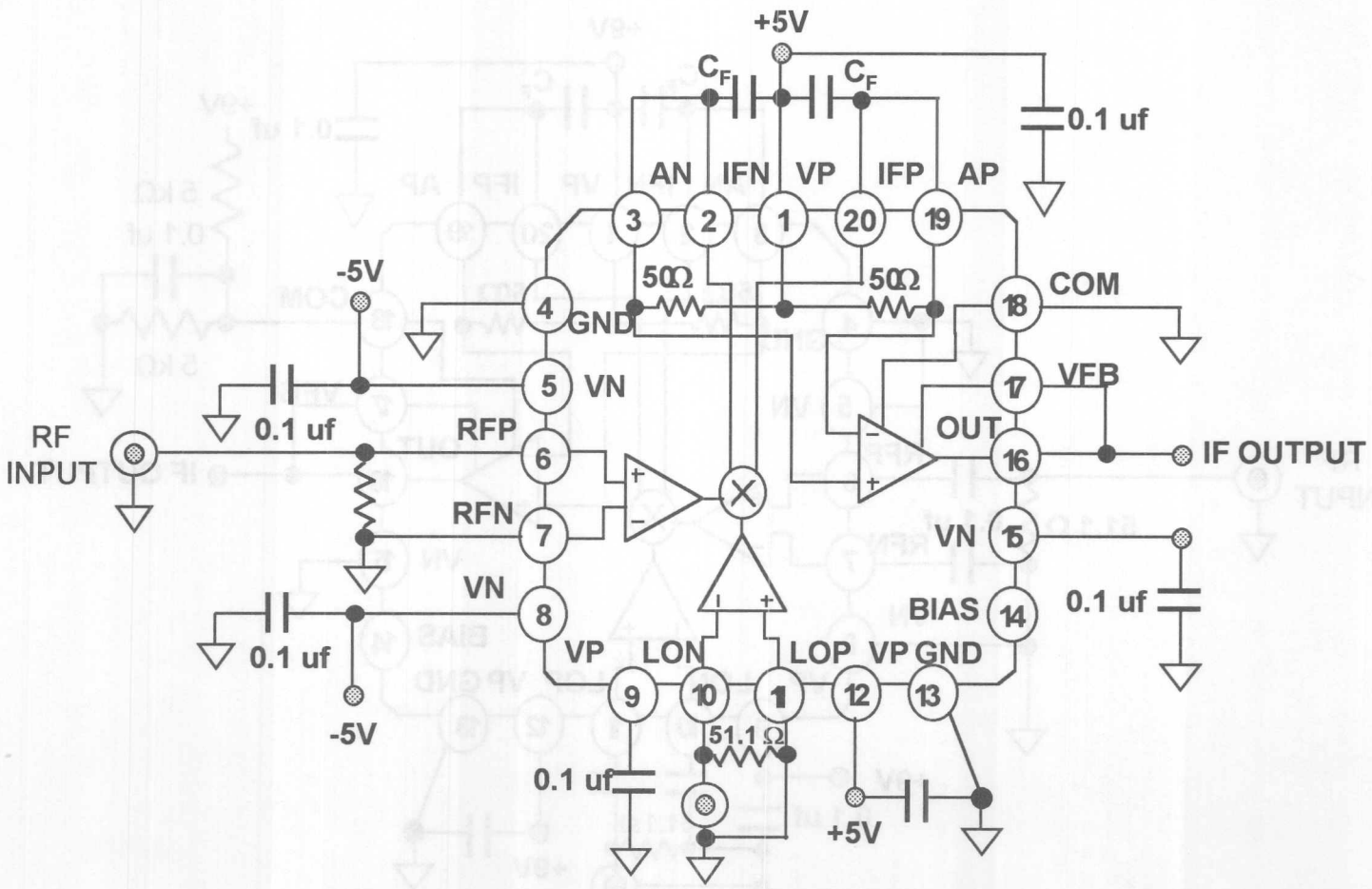
- High Port-Port Isolation: 70 dB, LO to RF
- No Insertion Loss
- Single + 9V or Dual ± 5.0V Supply Operation
- Operating Temperature Range: -40° C to + 85° C
- 20-Lead PLCC Package



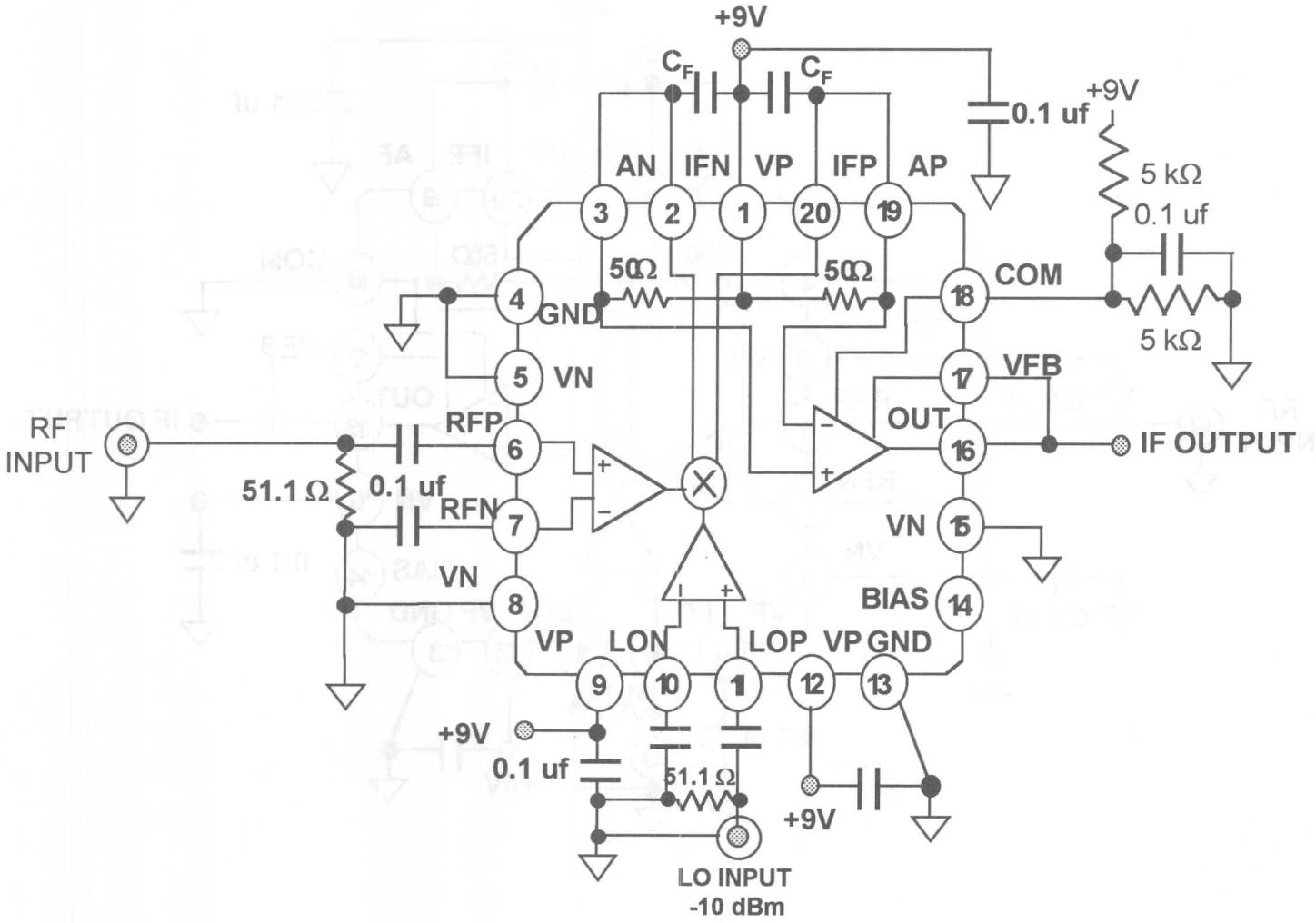
3rd Order Intercept vs Frequency



LO to RF Isolation vs Frequency



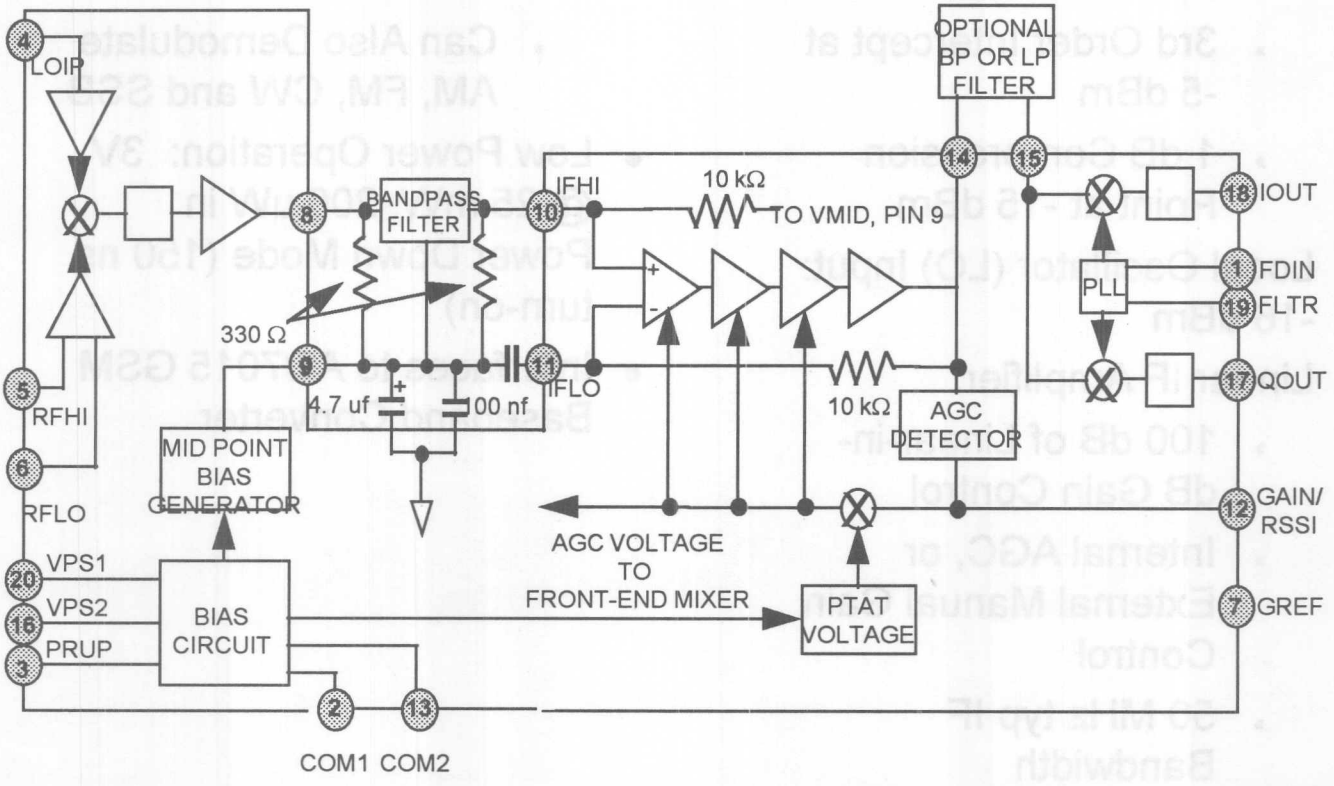
Connections for ± 5V Dual Supply Operation



Connections for + 9V Single Supply Operation (AC-Coupled IF Output)

AD607*
3V Low Power, Mixer/AGC/RSSI Receiver IF Subsystem

The AD607 is a complete, 3V low power, receiver IF subsystem on a chip. It contains a low noise, "Gilbert Cell" doubly-balanced mixer, IF amplifiers, I & Q demodulators, PLL quadrature oscillator, AGC detector and biasing system with external power-down.



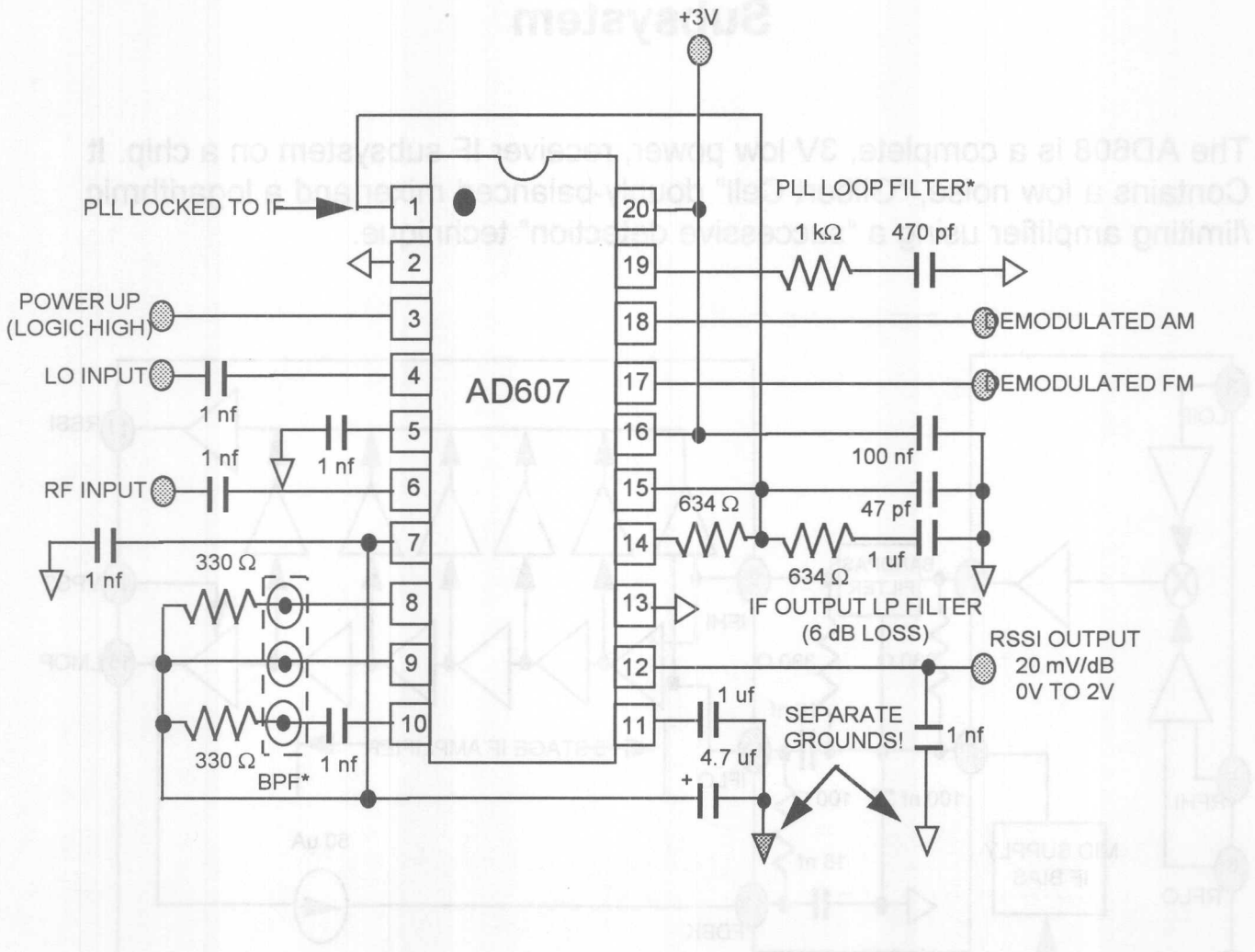
**Preliminary Technical Information*

KEY SPECS AND FEATURES:

- Low Noise, High Intercept Mixer:
  - 500 MHz RF and LO Bandwidth
  - 3rd Order Intercept at -5 dBm
  - 1 dB Compression Point at -15 dBm
- Local Oscillator (LO) Input: -16 dBm
- Linear IF Amplifier:
  - 100 dB of Linear-in-dB Gain Control
  - Internal AGC, or External Manual Gain Control
  - 50 MHz typ IF Bandwidth
- On-Board Phase-Locked Quadrature Demodulator:
  - Demodulates IF from 400 kHz to 22 MHz
  - Can Also Demodulate AM, FM, CW and SSB
- Low Power Operation: 3V @ 25 mW, 200 uW in Power Down Mode (150 ns turn-on)
- Interfaces to AD7015 GSM Baseband Converter

*Preliminary Technical Information

*Preliminary Technical

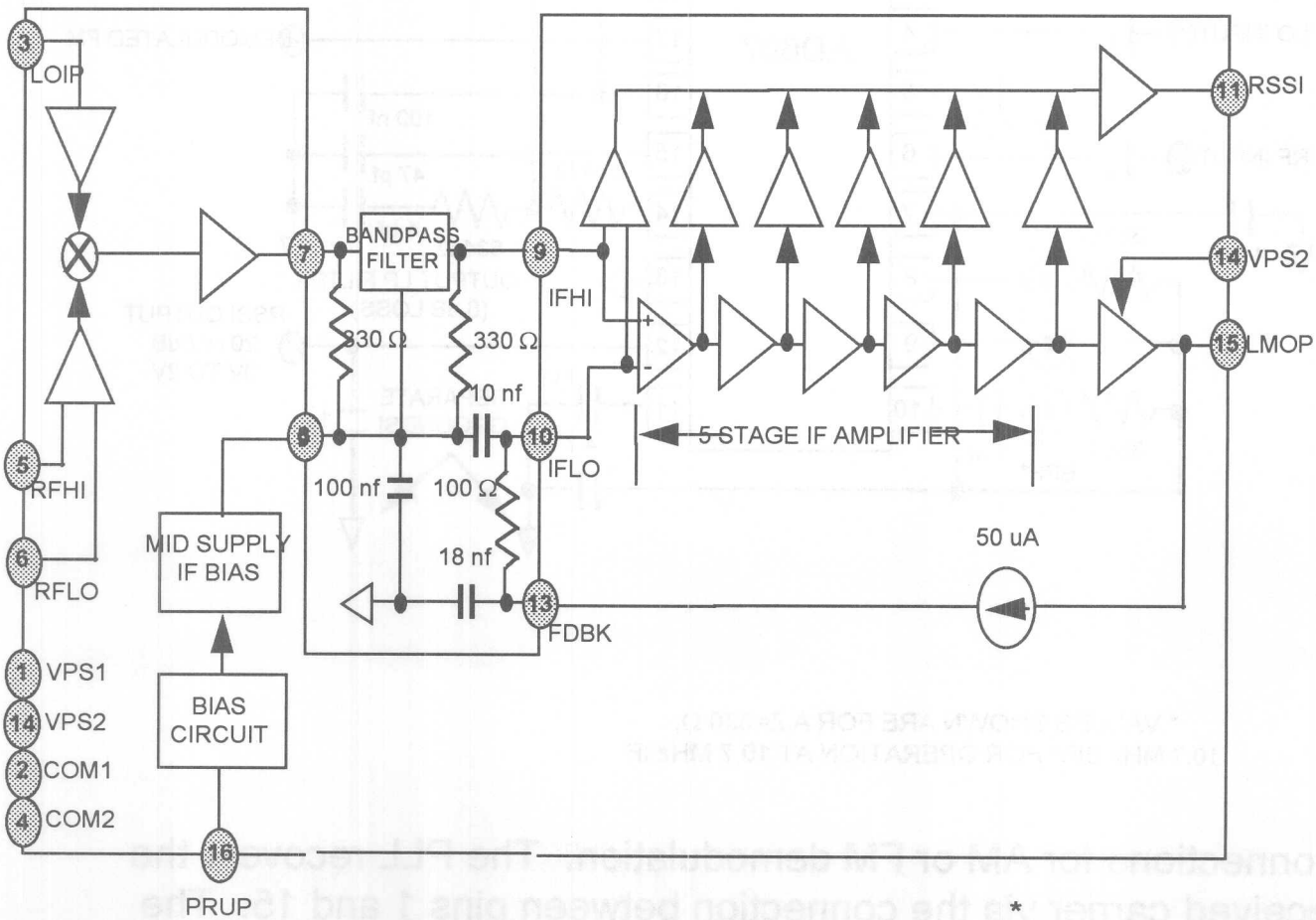


* VALUES SHOWN ARE FOR A Z=330 Ω,
10.7 MHz BPF FOR OPERATION AT 10.7 MHz IF

Connections for AM or FM demodulation. The PLL recovers the received carrier via the connection between pins 1 and 15. The AD607's internal AGC circuit controls the gain and provides an RSSI output at pin 12.

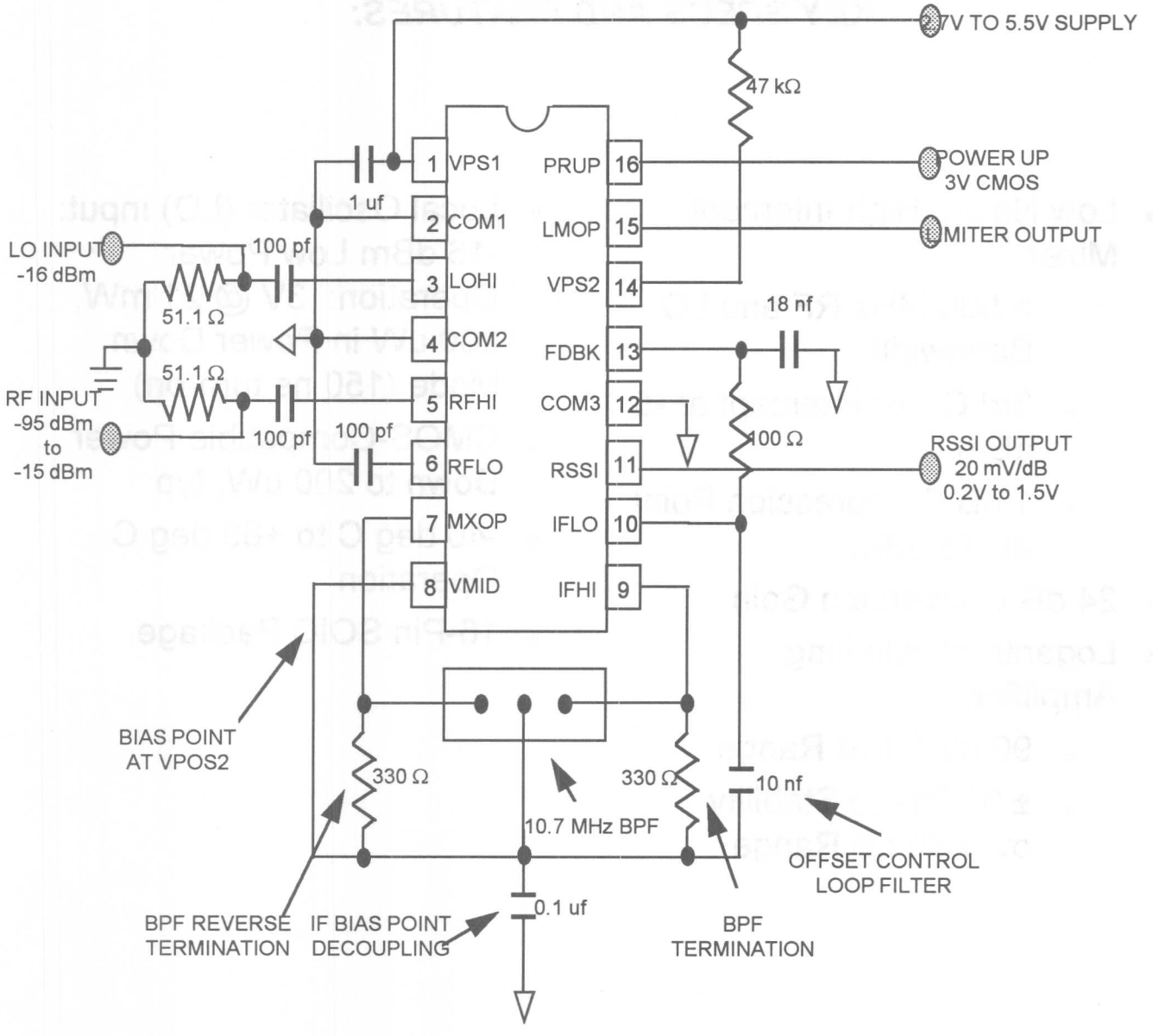
AD608
3V Low Power, Mixer/Limiter/RSSI Receiver IF Subsystem

The AD608 is a complete, 3V low power, receiver IF subsystem on a chip. It Contains a low noise, "Gilbert Cell" doubly-balanced mixer and a logarithmic /limiting amplifier using a "successive detection" technique.

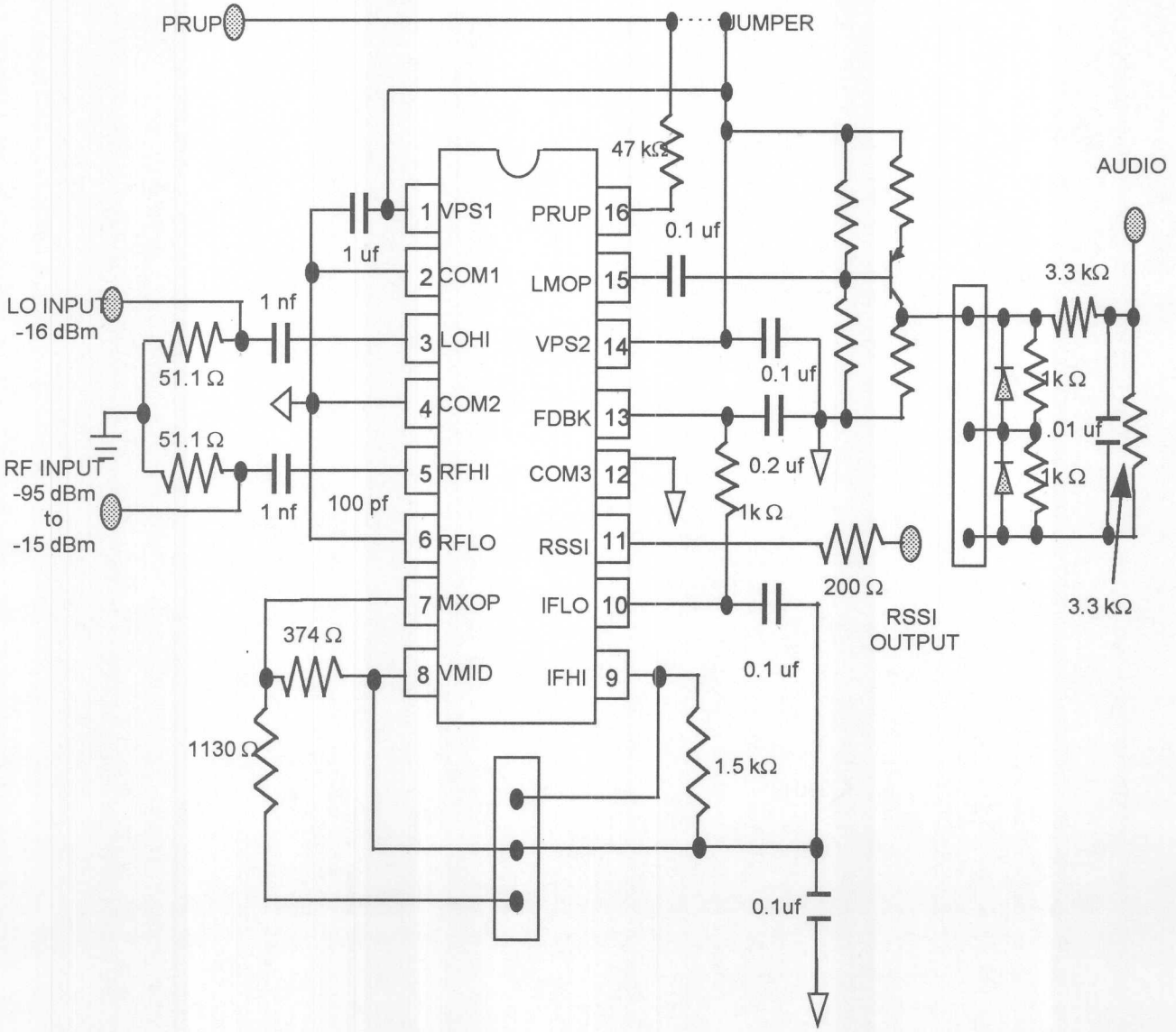


KEY SPECS AND FEATURES:

- Low Noise, High Intercept Mixer:
  - > 500 MHz RF and LO Bandwidth
  - 3rd Order Intercept at -5 dBm
  - 1 dB Compression Point at -15 dBm
- 24 dB Conversion Gain
- Logarithmic/Limiting Amplifier:
  - 90 dB RSSI Range
  - ± 3° Phase Stability over 80 dB Range
- Local Oscillator (LO) Input: -16 dBm Low Power Operation: 3V @ 21 mW, 200 uW in Power Down Mode (150 ns turn-on)
- CMOS-Compatible Power Down to 200 uW, typ
- -40 deg C to +85 deg C Operation
- 16-Pin SOIC Package



Basic Application Circuit for a 10.7 MHz IF.

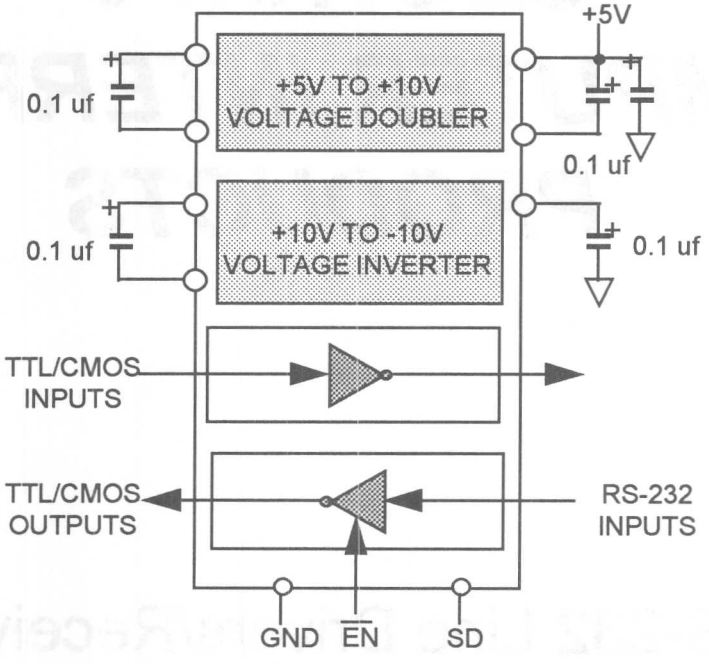


Narrow band FM Application Circuit Using Discriminator at 450 kHz IF

SECTION 9
COMPUTER INTERFACE PRODUCTS

RS-232 Line Drivers/Receivers
Line Drivers/Receivers for Notebook PCs

ADM202 - ADM242
+5V, 120/200 kB/s,
RS-232 Line Drivers/Receivers

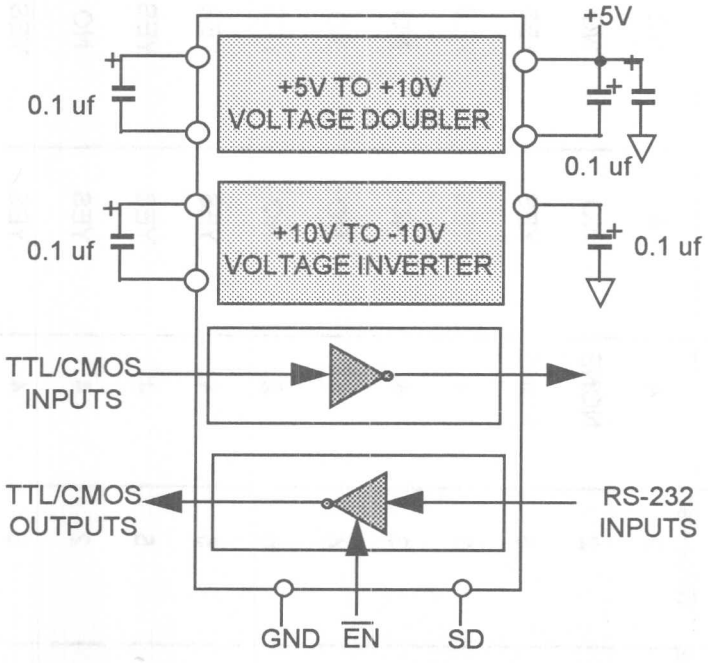


- High Speed Data Rates :
  - 120 kB/s : ADM202 - ADM223
  - 200 kB/s : ADM222/232A/242
- Plug-In Upgrade to ADI's Popular AD23X Series (0.1 uf vs 1.0 uf Capacitors)
- Lower Power (approx 1/3), Second-Source Upgrade to MAX20X and MAX21X Series
- 2 Receivers Active in Shutdown (ADM213)
- ± 30V Receiver Input Levels
- ± 9V Output Levels
- Latch Free - ESD Protection > 2 kV
- Low Power, Single +5V Supply Operation:
  - < 9 mA Normal Mode
  - < 10 uA Shutdown Mode
- -40 deg C to +85 deg C Operation
  - ADM202, ADM203 : 0 to 70 deg C

Part Number	Power Supply Voltage	No of RS-232 Drivers	No of RS-232 Receivers	External Capacitors	Low Power Shutdown	TTL Three State Enable	No of Pins	Package Styles
ADM202	+5V	2	2	4	NO	NO	16	DIP, SOIC
ADM203	+5V	2	2	NONE	NO	NO	20	DIP
ADM205	+5V	5	5	NONE	YES	YES	24	DIP
ADM206	+5V	4	3	4	YES	YES	24	DIP, SOIC, SSOP
ADM207	+5V	5	3	4	NO	NO	24	DIP, SSOP
ADM208	+5V	4	4	4	NO	NO	24	DIP, SOIC, SSOP
ADM209	+5V +(7.5-13)V	3	5	2	NO	YES	24	DIP, SOIC, SSOP
ADM211	+5V	4	5	4	YES	YES	28	SOIC, SSOP
ADM213	+5V	4	5	4	YES	YES	28	SOIC, SSOP
ADM222	+5V	2	2	4	YES	NO	18	DIP, SOIC
ADM223	+5V	4	5	4	YES	YES	28	SOIC, SSOP
ADM232A	+5V	2	2	4	NO	NO	16	DIP, SOIC
ADM242	+5V	2	2	4	YES	YES	18	DIP, SOIC

ADM560/561
+3V, 116 kB/s, Notebook PC, Serial Port Drivers/Receivers

The ADM560 and ADM561 are ultra-low power, serial line driver/receiver interface devices optimized for use in laptop and notebook computers.

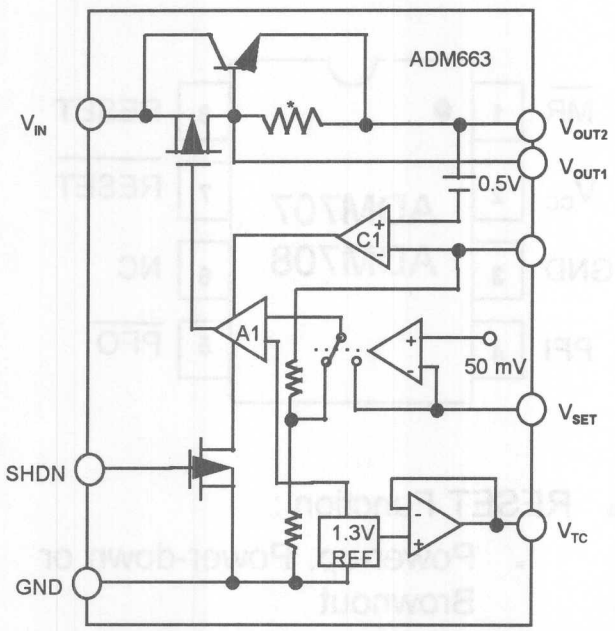


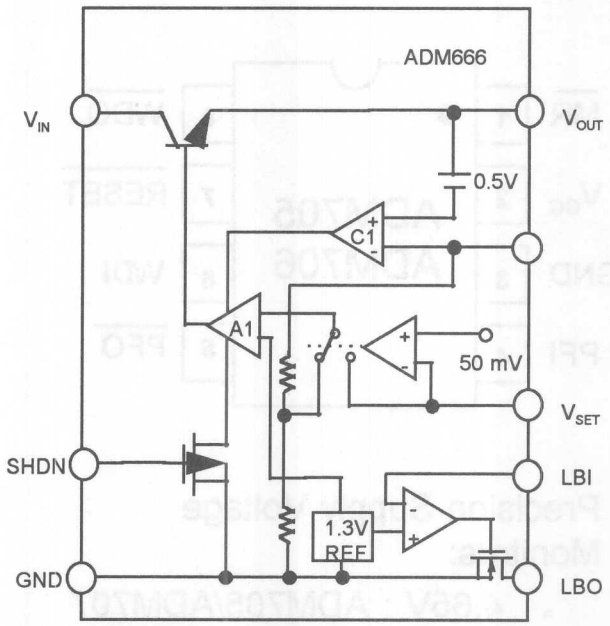
- 116 kB/s Transmission Rate
- Single + 3.0V to + 3.6V Supply Operation
- Ultra-Low Power Consumption:
  - 6.6 mW max in Normal Mode
  - 16.5 uW max (1.0 uW, typ) in Shutdown Mode
- Meets EIA/TIA-562 Standard Under Full Load
- 28-Pin SOIC and SSOP Packages
- Shutdown (SHDN) Feature:
  - ADM560: Active LO, 2 Receivers Remain Active
  - ADM561: Active HI, All Receivers Inactive

SECTION 10
MICROPROCESSOR POWER MANAGEMENT AND SUPERVISORY PRODUCTS

Micropower Linear Voltage Regulators
Microprocessor Supervisory Circuits

ADM663A/ADM666A
Micropower Linear Voltage Regulators

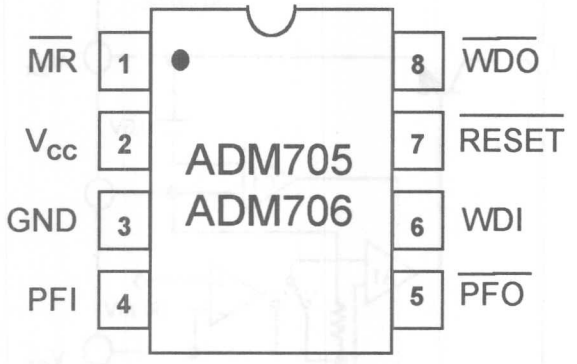


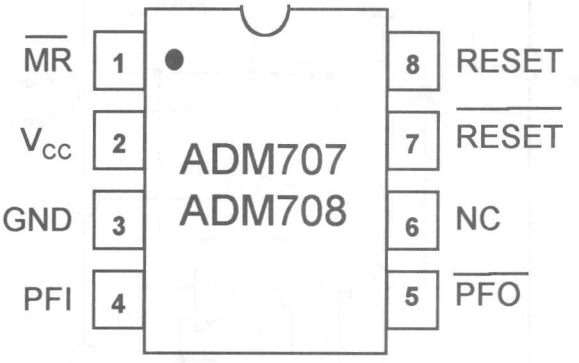


- Pin-Compatible Upgrade to MAX663 and MAX666
- Low Power CMOS Operation:
  - +2V to +16.5V Operating Range
  - Only 9 uA Max Quiescent Current
- 100 mA Output Current
- Adjustable Current Limiting
- Low Power Shutdown (SHDN) Feature
- 2.5 mV/ °C Auxiliary Output for LCD's (ADM663)
- Low Battery Detection (ADM666)
- 4 kV ESD Protection
- 8-Pin DIP and SOIC Packages
- -40 deg C to +85 deg C Operation

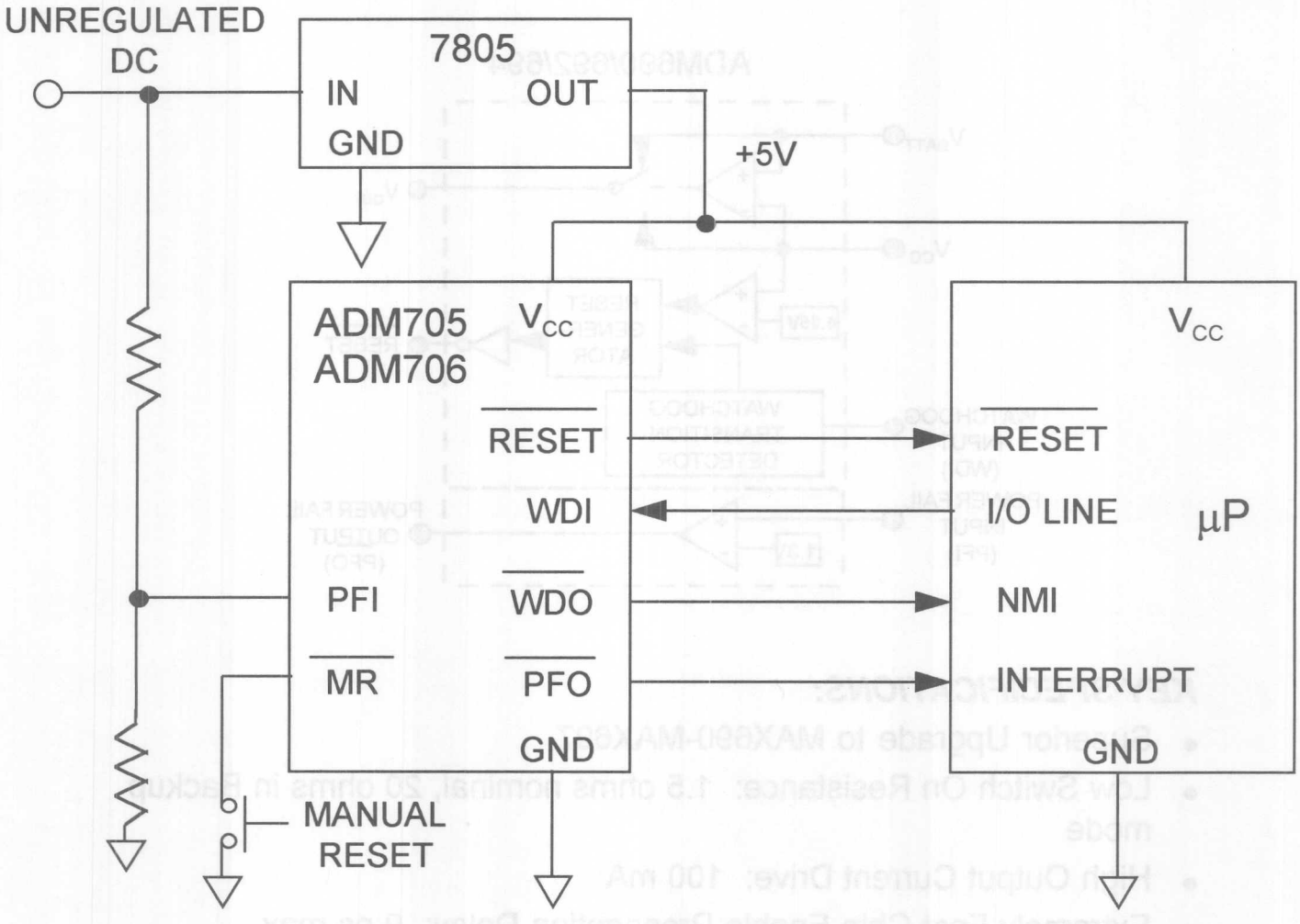
ADM705 - ADM708
Microprocessor Supervisory Circuits

The ADM705-ADM708 are low cost, high performance upgrades to the Maxim MAX705 - MAX708.





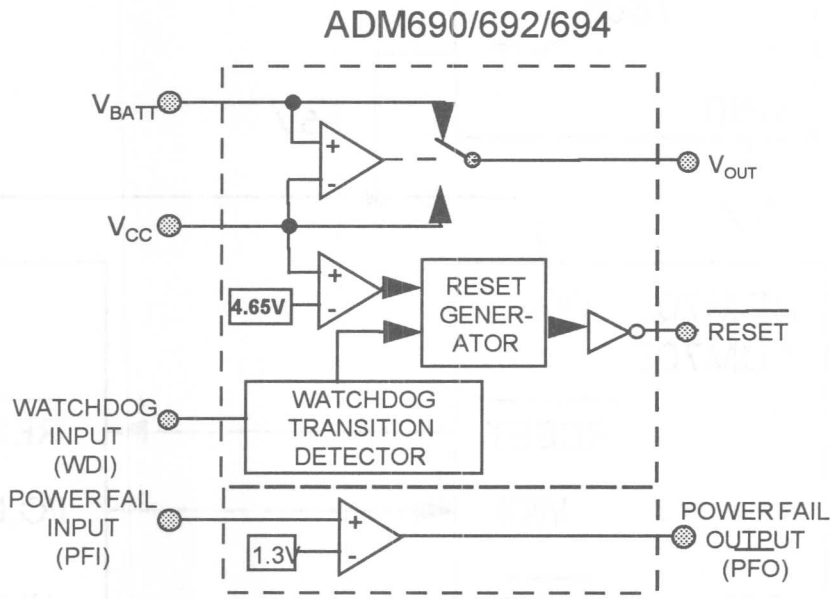
- Precision Supply Voltage Monitors:
  - 4.65V : ADM705/ADM707
  - 4.40V : ADM706/ADM708
- Independent Watchdog Timer with 1.6 sec Timeout (ADM705/ADM706)
- 1.25V Threshold Detector for Power Fail Warning or Low Battery Detection
- Only 200 uA Quiescent Current
- RESET Function :
  - Power-up, Power-down or Brownout
  - Guaranteed Valid at V_{CC} = 1 Volt
  - 200 ms Pulse Width
  - Active LOW (all)
  - Active HIGH (ADM707/ADM708)
  - Debounced TTL/CMOS-Compatible Manual Input
- -40 deg C to +85 deg C Operation
- 8-Pin Plastic DIP, SOIC and SSOP Packages



Typical Operating Circuit

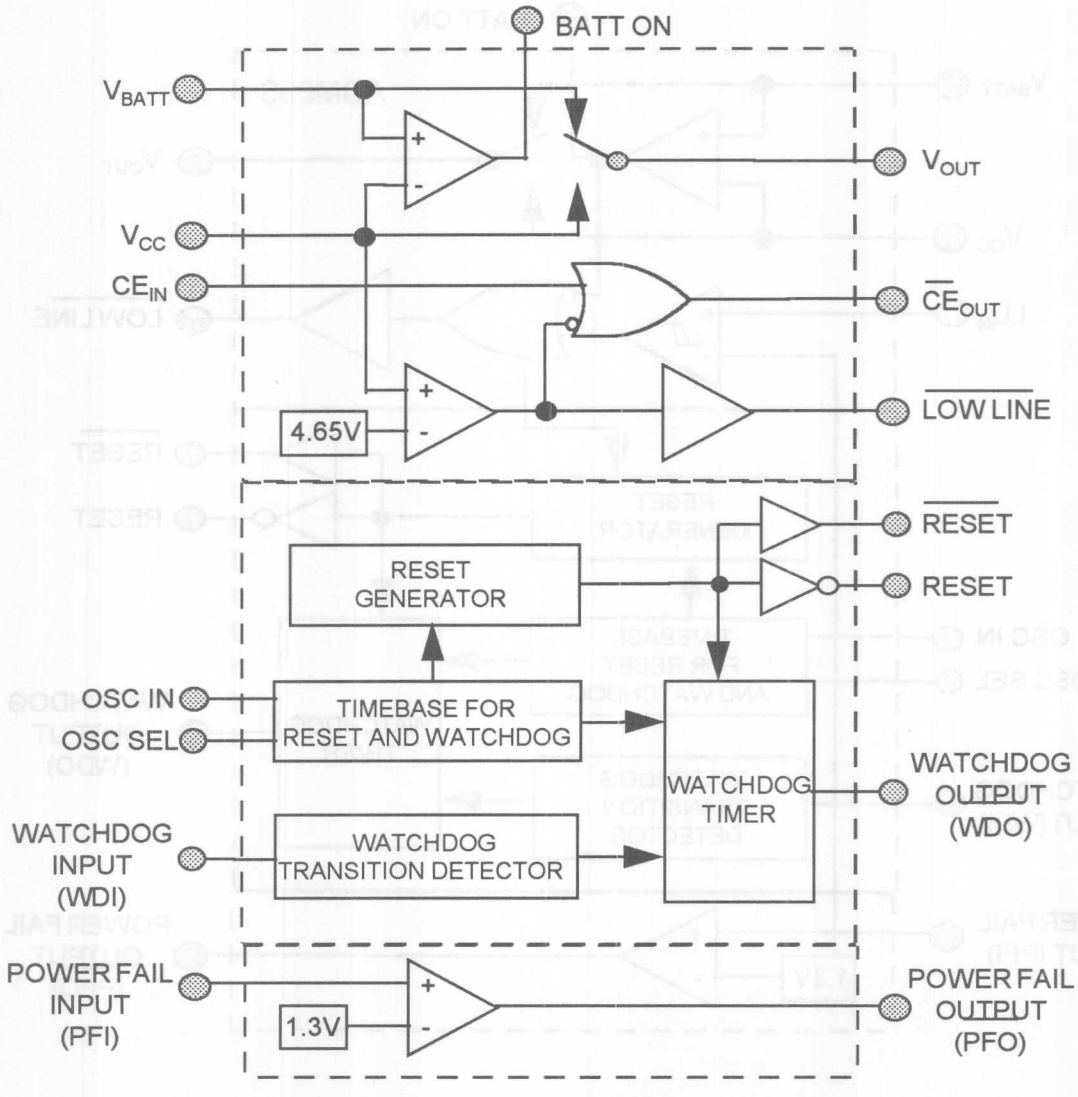
ADM690 - ADM697
Microprocessor Supervisory Circuits

The AD690-697 family offers complete, single-chip solutions for power supply monitoring and battery control functions in microprocessor-based systems.

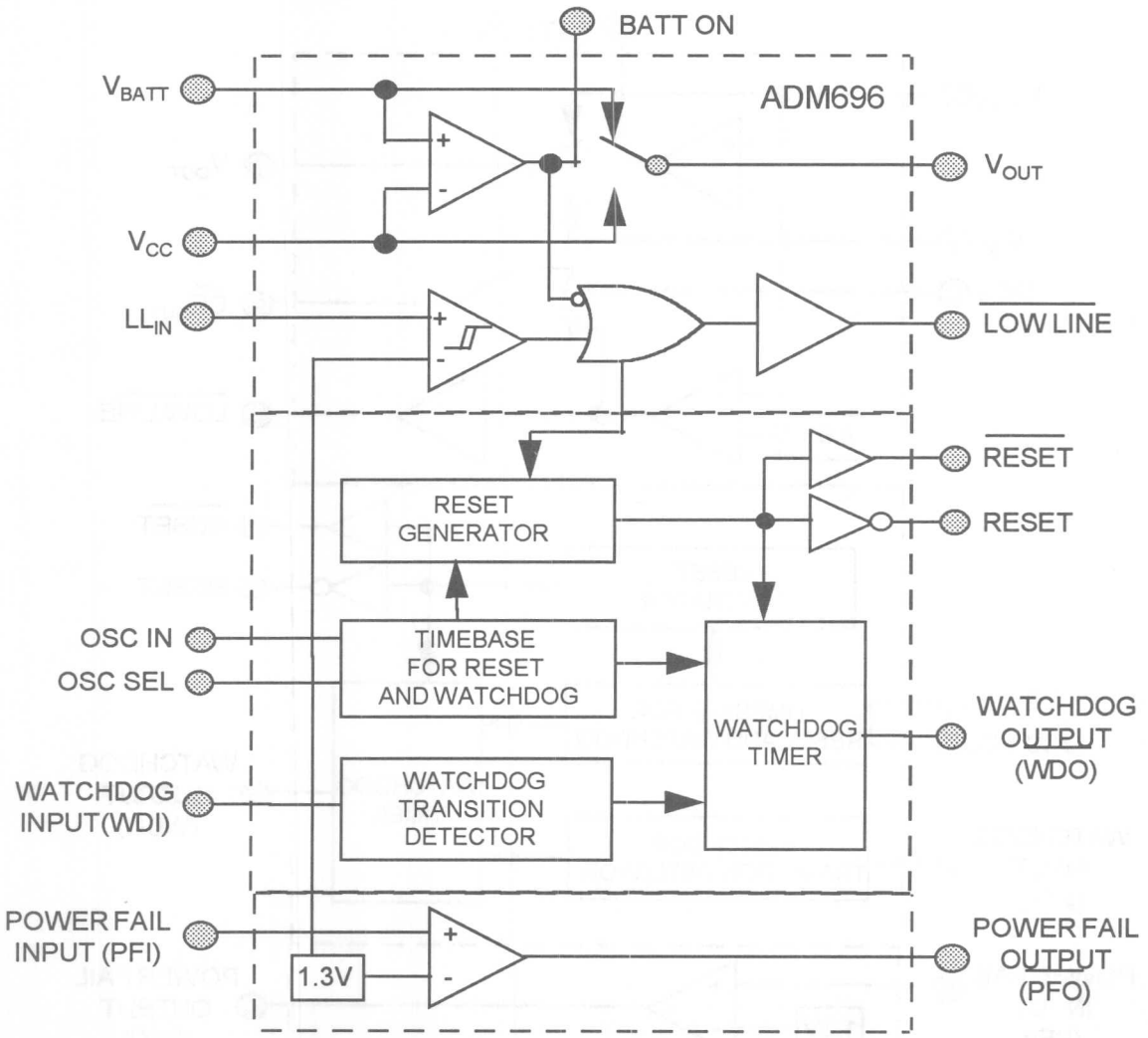


KEY SPECIFICATIONS:

- Superior Upgrade to MAX690-MAX697
- Low Switch On Resistance: 1.5 ohms nominal, 20 ohms in Backup mode
- High Output Current Drive: 100 mA
- Extremely Fast Chip Enable Propagation Delay: 9 ns max
- Very Low Power Dissipation : 5 mW
- 8 or 16-Pin Plastic DIP (N), CerDIP (Q) and SOIC (R) Packages
- Operating Temp Ranges:
  - -40 deg C to +85 deg C (N,Q,R)
  - -55 deg C to +125 deg C (Q)



- RESET Function Occurs During Power-up, Power-down or Brownout Conditions
  - » Operational with V_{CC} down to 1 Volt
- Automatically Switches to Battery Mode if V_{CC} Falls Below Threshold
- Watchdog Timer monitors microprocessor activity and generates a RESET pulse if WDI has not been toggled by the microprocessor within a specified time.



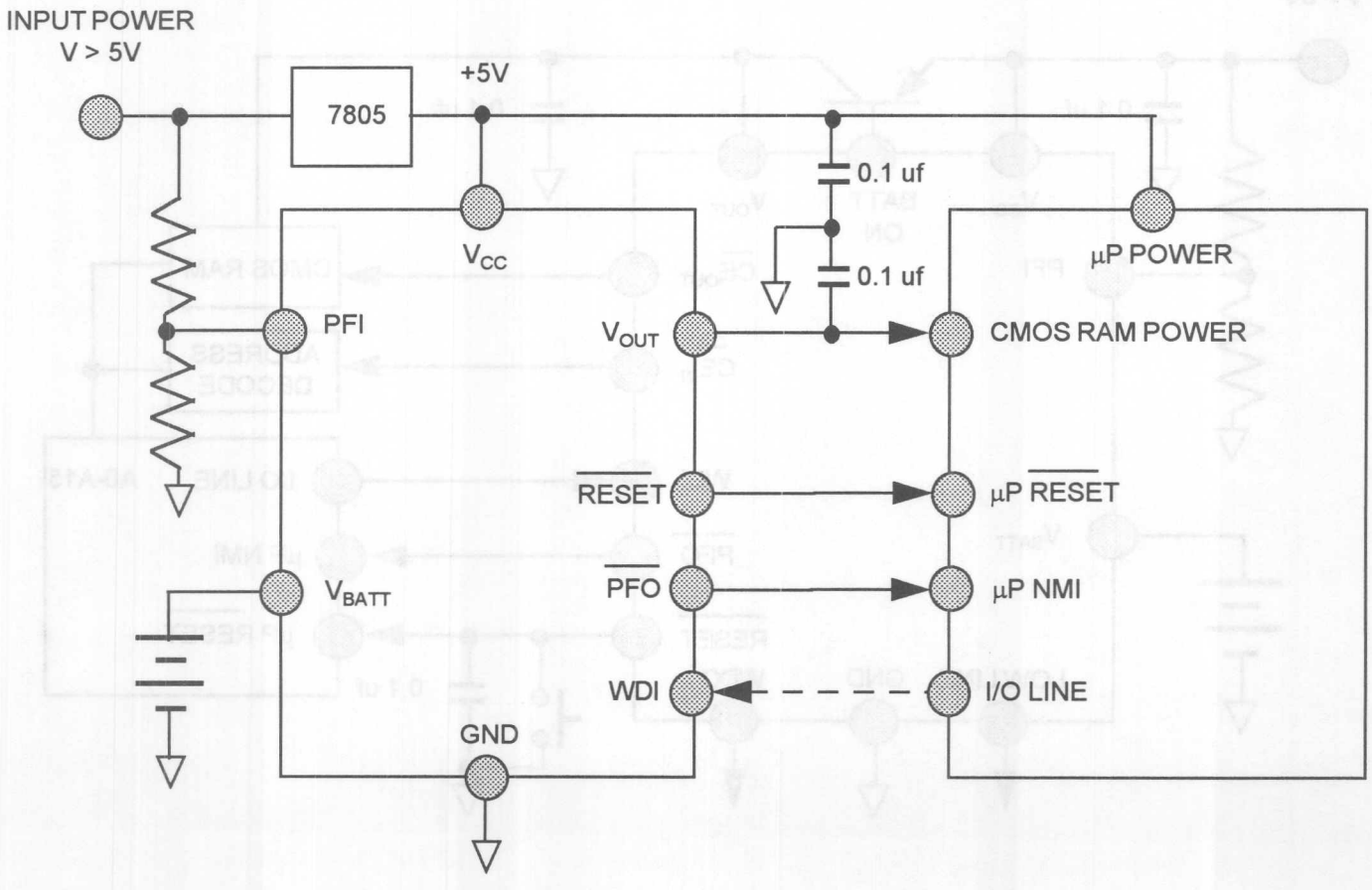
- 1.3V Threshold Detector for Power Fail Warning, Low Battery Detection, or to Monitor Supply Other Than + 5V
- CE output toggles high if V_{CC} or V_{BATT} falls below reset threshold to prevent invalid write commands to CMOS RAM or EEPROM.
- Adjustable Reset and Watchdog Timeout periods.
- Separate Watchdog Timeout, Battery Backup Switchover, Low Line and Low V_{CC} Status Outputs

PRODUCT SELECTION GUIDE

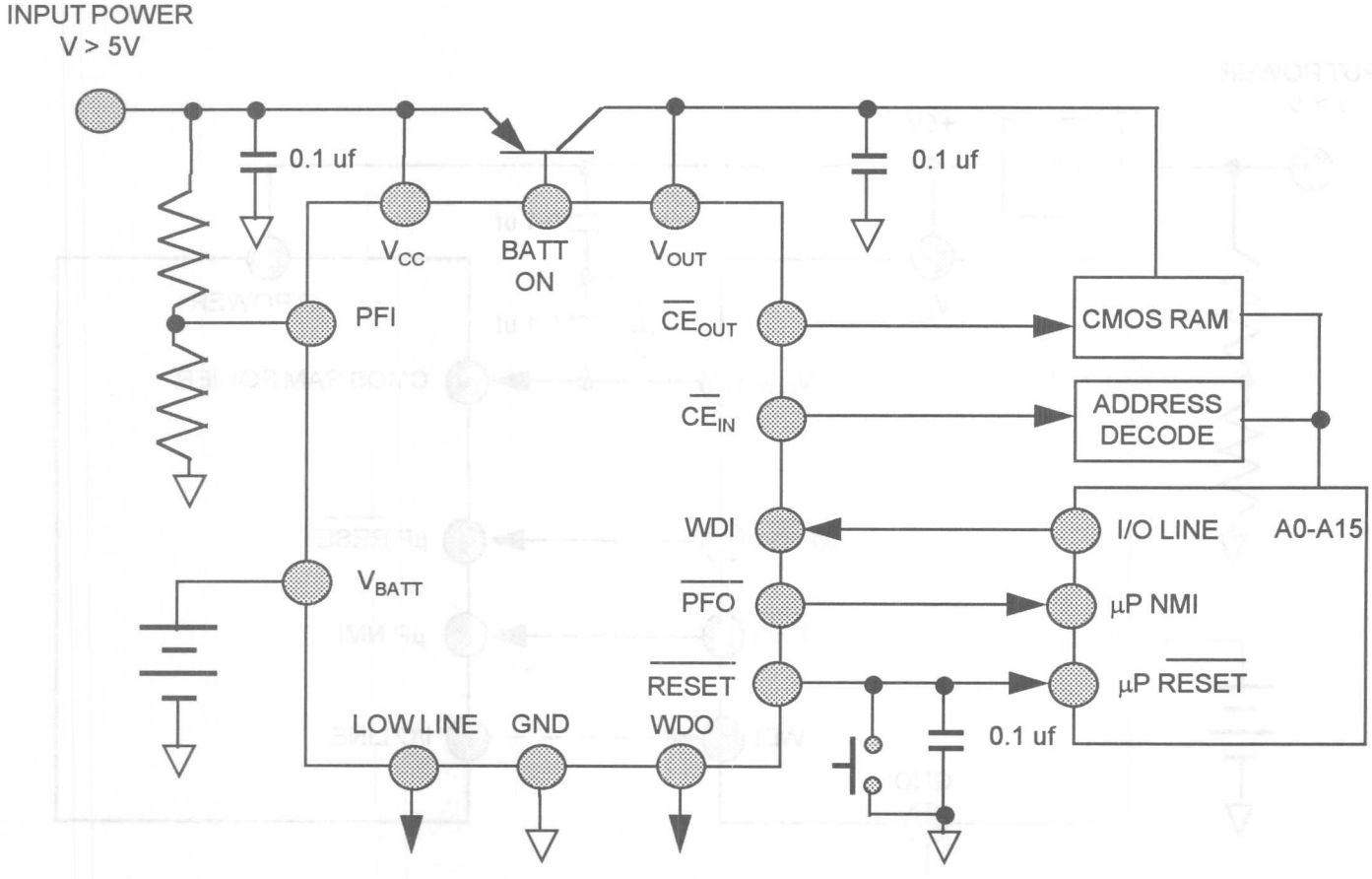
	ADM690	ADM691	ADM692	ADM693	ADM694	ADM695	ADM696	ADM697
Power-on Reset	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Battery Backup Switching	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Watchdog Timer Reset	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.3V Threshold Detector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WRITE Protection of CMOS RAM or EEPROM	No	Yes	No	Yes	No	Yes	No	Yes
Adjustable Reset and Watchdog Timeout Periods	No	Yes	No	Yes	No	Yes	Yes	Yes
Low Line Status Output	No	Yes	No	Yes	No	Yes	Yes	Yes
Watchdog Status Output	No	Yes	No	Yes	No	Yes	Yes	Yes

Part Number	Nominal Reset Time	Nominal V_{cc} Reset Threshold	Nominal Watchdog Timeout Period	Battery Backup Switching	Base Drive External PNP	Chip Enable Signals
ADM690	50 ms	4.65 V	1.6 sec	Yes	No	No
ADM691	50ms or ADJ	4.65 V	100 ms, 1.6 sec or ADJ	Yes	Yes	Yes
ADM692	50 ms	4.4 V	1.6 sec	Yes	No	No
ADM693	50 ms or ADJ	4.4 V	100 ms, 1.6 sec or ADJ	Yes	Yes	Yes
ADM694	200 ms	4.65 V	1.6 sec	Yes	No	No
ADM695	200 ms or ADJ	4.65 V	100 ms, 1.6 sec or ADJ	Yes	Yes	Yes
ADM696	50 ms or ADJ	1.3V	100 ms, 1.6 sec or ADJ	Yes	Yes	No
ADM697	50 ms or ADJ	1.3V	100 ms, 1.6 sec or ADJ	No	No	Yes

Nominal Reset Times, Reset Thresholds and Switching Time Periods



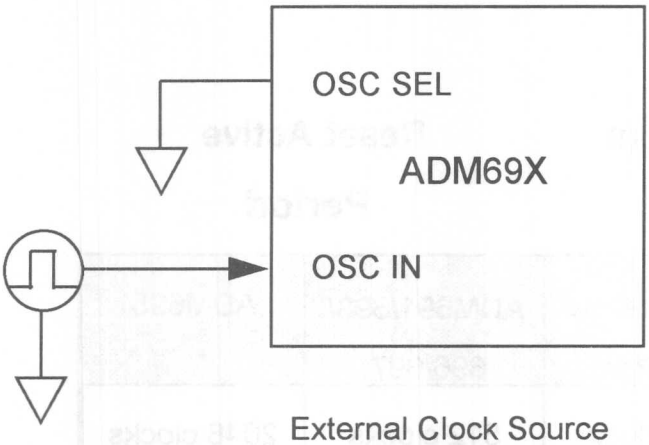
ADM690/692/694 Typical Application Circuit



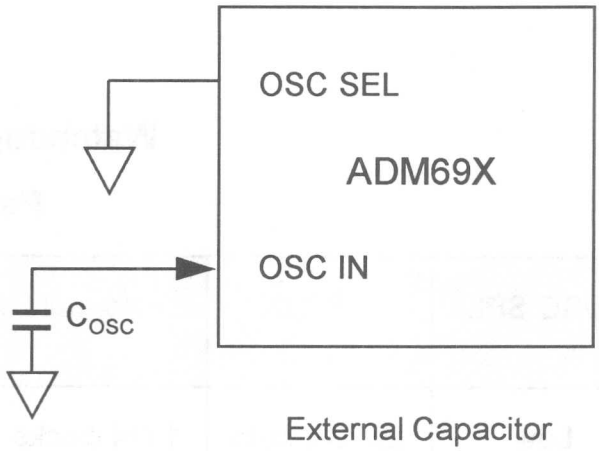
ADM691/693/695 Typical Application Circuit

		Watchdog Timeout Period		Reset Active Period	
OSC SEL	OSC IN	Normal	Immediately After Reset	ADM691/693/ 696/697	ADM695
Low	Ext Clock In	1024 clocks	4096 clocks	512 clocks	2048 clocks
Low	Ext Capacitor	400 ms x C/47 pf	1.6 s x C/47 pf	200 ms x C/47 pf	800ms x C/47 pf
Floating/High	Low	100 ms	1.6 s	50 ms	200 ms
Floating/High	Floating/High	1.6 s	1.6 s	50 ms	200 ms

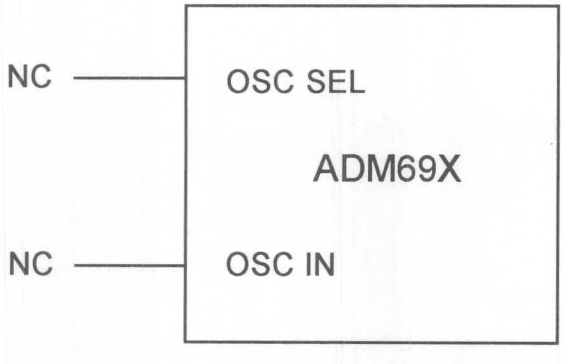
ADM691, ADM693, ADM695 and ADM697 Reset Pulse Width and Watchdog Timeout Selections



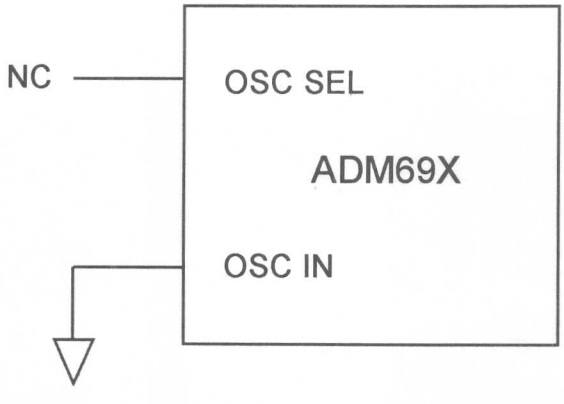
External Clock Source



External Capacitor



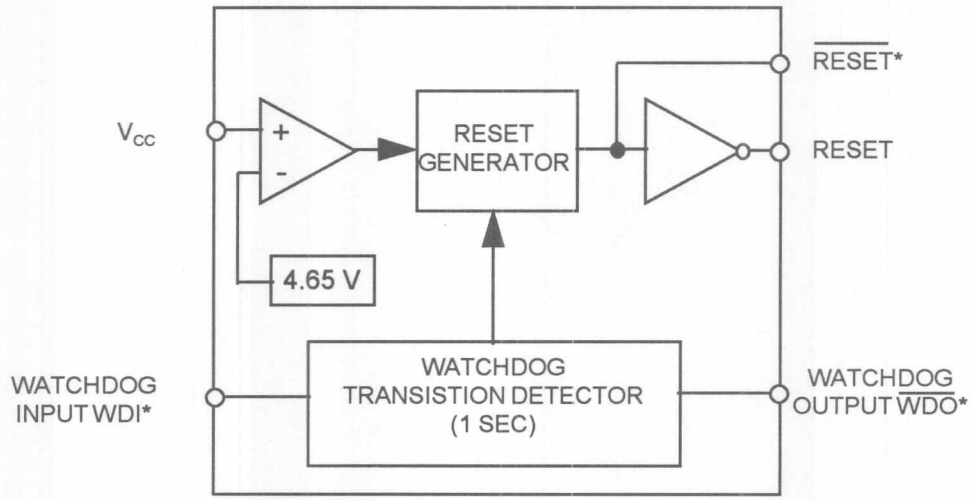
Internal Oscillator
(1.6 sec watchdog)



Internal Oscillator
(100 ms watchdog)

ADM698/ADM699 Microprocessor Supervisory Circuits

The AD698 and ADM699 offer a complete, *low-cost* single-chip solution for power supply monitoring and watchdog timing for microprocessor-based systems.



* WDI : ADM699, only
RESET : SOIC, only
WDO : ADM699 SOIC, only

- Superior Upgrade to MAX698 and MAX699
- Precision, On-Chip 4.65 V Threshold Reference
- Power-on RESET During Power Up, Power Down or Brownout Condition ... Remains Operational with V_{CC} = 1 Volt
- Quiescent Supply Current only 600 uA
- Additional Watchdog Timer (ADM699) Generates RESET Pulse if WDI not Toggled by the Microprocessor Within 1 Second Period
- 8-Pin Plastic DIP (N) and CerDIP (Q) or 16-Pin SOIC (R) Packages
- Operating Temp Ranges:
  - -40 deg C to 85 deg C (all)
  - -55 deg C to 125 deg C (Q)

SECTION 11
DIGITAL SIGNAL PROCESSING

16 Bit, Fixed Point ROM-Coded Processors
16 Bit, Fixed Point High Speed Processors
Mixed Signal Processors

ADSP-216X Series
16-Bit, Fixed Point, ROM-Coded DSP Microprocessors

The ADSP-216x series are memory-variant, code and pin-compatible versions of our ADSP-2101 family of fixed-point processors, designed specifically for high volume OEM applications.

ADSP-216X KEY FEATURES:

- 20 MIPS (50 ns) Maximum Instruction Rate (ADSP-2165*/ADSP-2166*)
- Factory-Programmed, on-Chip ROM-Programmed Memory for Program and Data Storage :
  - Eliminates the Need for an External Boot EPROM in the System
  - Eliminates the Need for Any External Program Memory by Fitting the Entire Application Program Into on-Chip RAM
- Can Initially Prototype With ADSP-2101 or ADSP-2103
- Operating Temperature Ranges:
  - 0 deg C to +70 deg C
  - -40 deg C to +85 deg C

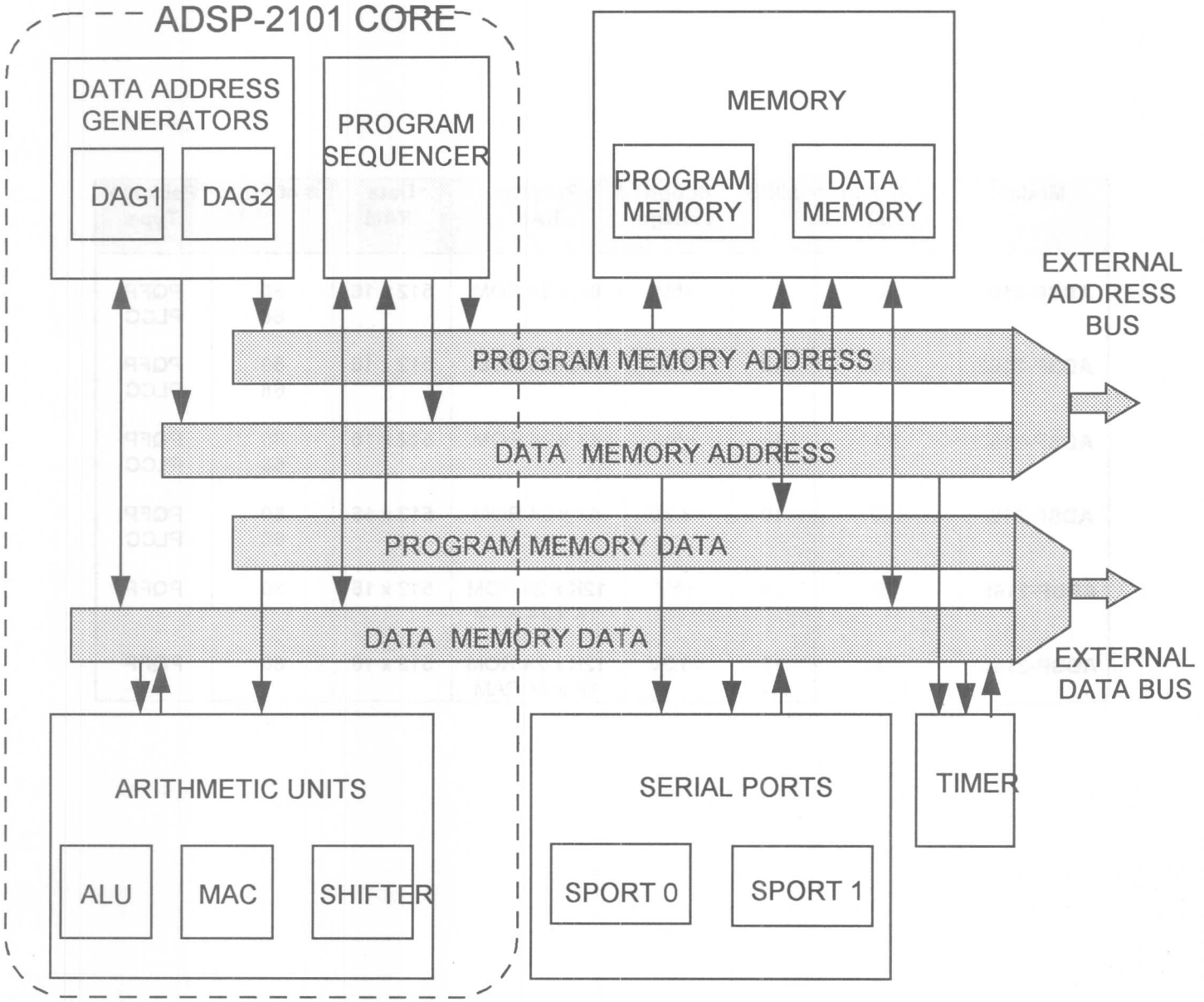
**Preliminary Technical Information*

ADSP-2100 SERIES BASIC FEATURES:

- Separate On-Chip Buses for Program and Data Memory
- Enhanced Harvard Architecture for Three Bus Performance
  - Program Memory Stores Both Instructions and Data
- Independent Computation Units : ALU, Mulitplier/Accumulator and Shifter
- Single Cycle Instruction, Execution and Multifunction Instructions
- Integrated I/O Peripherals:
  - 2 Serial Ports
  - Program Timer
- Low Power Operation :
  - +3.3V : < 20 mA Normal, < 6 mA Idle
  - +5.0V : < 60 mA Normal, < 20 mA Idle

Model	Cycle Time (ns)	MIPS	Supply Voltage	Program RAM	Data RAM	# of Pins	Package Type
ADSP-2161	60	16	+5V	8K x 24 ROM	512 x 16	80 68	PQFP PLCC
ADSP-2162	100	10	+3.3V	8K x 24 ROM	512 x 16	80 68	PQFP PLCC
ADSP-2163	60	16	+5V	4K x 24 ROM	512 x 16	80 68	PQFP PLCC
ADSP-2164	100	10	+3.3V	4K x 24 ROM	512 x 16	80 68	PQFP PLCC
ADSP-2165*	50	20	+5V	12K x 24 ROM 1K x 24 RAM	512 x 16	80	PQFP
ADSP-2166*	72	13	+3.3V	12K x 24 ROM 1K x 24 RAM	512 x 16	80	PQFP

Summary of Key Features


ADSP-2101 CORE
DATA ADDRESS GENERATORS
DAG1
DAG2
PROGRAM SEQUENCER
MEMORY
PROGRAM MEMORY
DATA MEMORY
EXTERNAL ADDRESS BUS
PROGRAM MEMORY ADDRESS
DATA MEMORY ADDRESS
PROGRAM MEMORY DATA
DATA MEMORY DATA
EXTERNAL DATA BUS
ARITHMETIC UNITS
ALU
MAC
SHIFTER
SERIAL PORTS
SPORT 0
SPORT 1
TIMER

ADSP-2171/2173 and ADSP-2181* 16-Bit, 33 MIPS, Fixed-Point DSP Microprocessors

The ADSP-2171 and ADSP-2181 are high speed (33 MIPS) DSP Microprocessors based on ADI's ADSP-2101 core technology. The ADSP-2173 is a +3.3V, 20 MIPS version of the ADSP-2171.

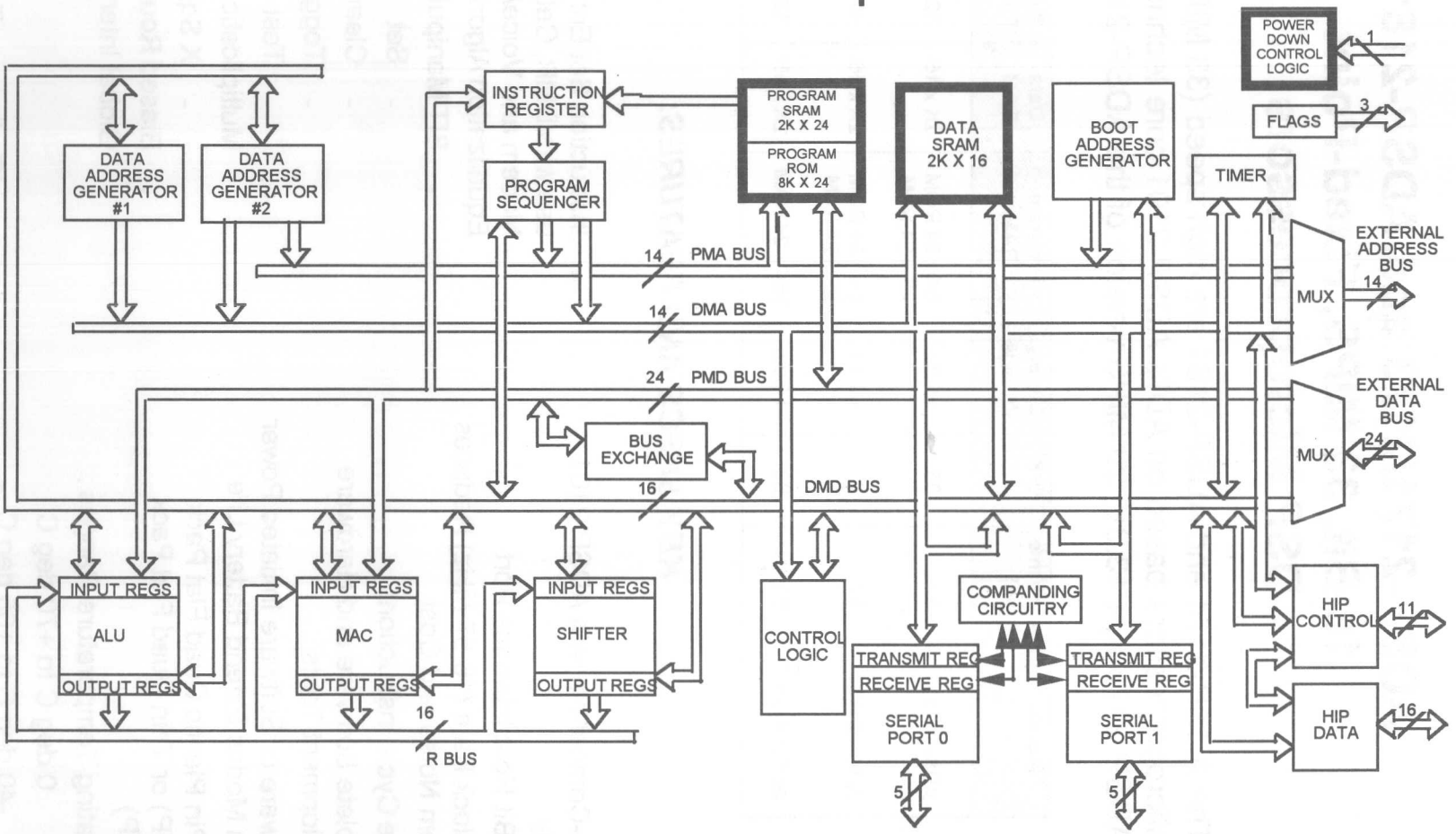
Model	Cycle Time (ns)	MIPS*	Supply Voltage	Program RAM	Data RAM	# of Pins	Package Styles
ADSP-2171	30	33	+5.0V	8K x 24 ROM 2K x 24 RAM	2K x 16	128	PQFP TQFP
ADSP-2173	50	20	+3.3V	8K x 24 ROM 2K x 24 RAM	2K x 16	128	PQFP TQFP
ADSP-2181	30	33	+5.0V	16K x 24 RAM	2K x 16	128	PQFP

KEY SPECS AND FEATURES:

- Code-Compatible with ADSP-2101 Family
- 8/16 Bit Host Interface Port
- 1/2 Clock Rate (16.67 MHz) Reduces System Noise and Cost
- Single Cycle Instructions
- Complete Software and Hardware Development Tools
- Hardware or Software Initiated Power Down Modes Extend Battery Life
- 128 Pin Plastic Quad Flat Pack (PQFP) or Thin Quad Flat Pack (TQFP)
- Operating Temperature Ranges :
  - 0 deg C to +70 deg C
  - -40 deg C to +85 deg C
- Instruction Set Enhancements for use with DMR, Cellular Radio, Modem and Voice/Speech Equalization Algorithms:
  - BIT Manipulation
    - Set
    - Clear
    - Toggle
    - Test
  - Multiplication
    - X Squared
  - Biased Rounding (GSM)
  - Global Interrupt Masking

**Preliminary Technical Information*

ADSP-2171
DSP Microcomputer



ADSP-2171/2173 and ADSP-2181* Power Consumption

- **Active Modes**
  - 5V Operation @ 33 MIPS (ADSP-2171/2173) : 300 mW
  - 3V Operation @ 20 MIPS (ADSP-2173) : 70 mW
- **Hardware-Initiated Low Power Mode**:
  - Power-down, CMOS Standby State, No Clocks Active
  - Typical Power Consumption with 100 Cycle Recovery:
    - 500 mW @ 5V
    - 300 mW @ 3V
- **Software-Initiated Low Power Mode (Zero Cycle Recovery):**
  - IDLE Mode
    - 65.5 mW @ 5V
    - 16.5 mW @ 3V
  - Slow IDLE Mode
    - 30 mW @ 5V
    - 7.5 mW @ 3V

ADSP-2171 and ADSP-2181 Benchmarks at 33 MIPS

Test	ADSP-2171	ADSP-2181
FIR Filter	30 ns per tap	30 ns per tap
IIR Biquad	210 ns per section	210 ns per section
GSM Speech Coding	2.04 ms	1.975 ms
IS-54 VSELP Speech Coding	9.78 ms	9.78 ms
1024 pt Complex Radix 4 DIT FFT	1.07 ms	1.07 ms
4096 pt Complex Radix 2 DIT FFT	na	6.6 ms
G.728 LD-CELP	na	93% loaded
V.32bis Modem	43% loaded	43% loaded
G.721 Wideband ADPCM	23% loaded	23% loaded
Stereo Music Synthesis	32% loaded	32% loaded
Stereo Music Synthesis with Q Sound	38% loaded	38% loaded
256 Point Complex FFT	0.22 ms	na
Lattice Filter Section	150 ns per section	na
10th Order LPC Analysis	0.14 ms	na

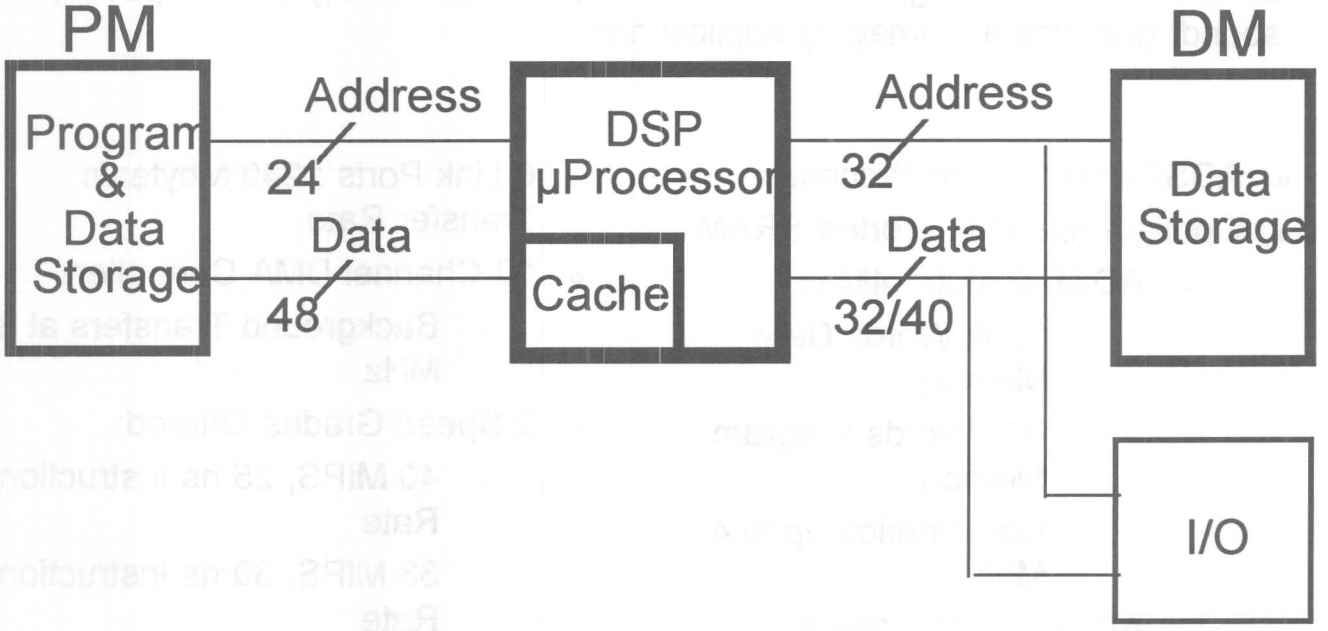
ADSP-21060/21062*
32 Bit, Floating Point SHARC DSPs

The ADSP-21060 and ADSP-21062 Super Harvard Architecture Computer (SHARC) provide a *complete* signal processing system on one chip! They are a new class of High Performance, "Super" DSPs designed for speech, sound, graphics and imaging applications.

- ADSP-21020 Core Processor
- Configurable Dual-Ported SRAM:
  - ADSP-21060 : 4Mbit
    - 128k Words Data Memory
    - 80k Words Program Memory
    - Combination up to 4 Mbit
  - ADSP-21062 : 2Mbit
    - 64k Words Data Memory
    - 40k Words Program Memory
    - Combination up to 2 Mbit
- Host Interface Port
- 2 Synchronous Serial Ports : 40 Mbits/sec
- 6 Link Ports : 240 Mbytes/s Transfer Rate
- 10 Channel DMA Controller
  - Background Transfers at 40 MHz
- 2 Speed Grades Offered:
  - 40 MIPS, 25 ns Instruction Rate
  - 33 MIPS, 30 ns Instruction Rate
- 120 MFLOPS Peak, 80 MFLOPS Sustained Performance
- Super Harvard Architecture Provides 4 Independent Buses for Dual Data, Instructions and I/O
- 32-Bit IEEE Floating Point Computation Units - Multiplier, ALU and Shifter
- 240 Lead Thermally Enhanced PQFP Package

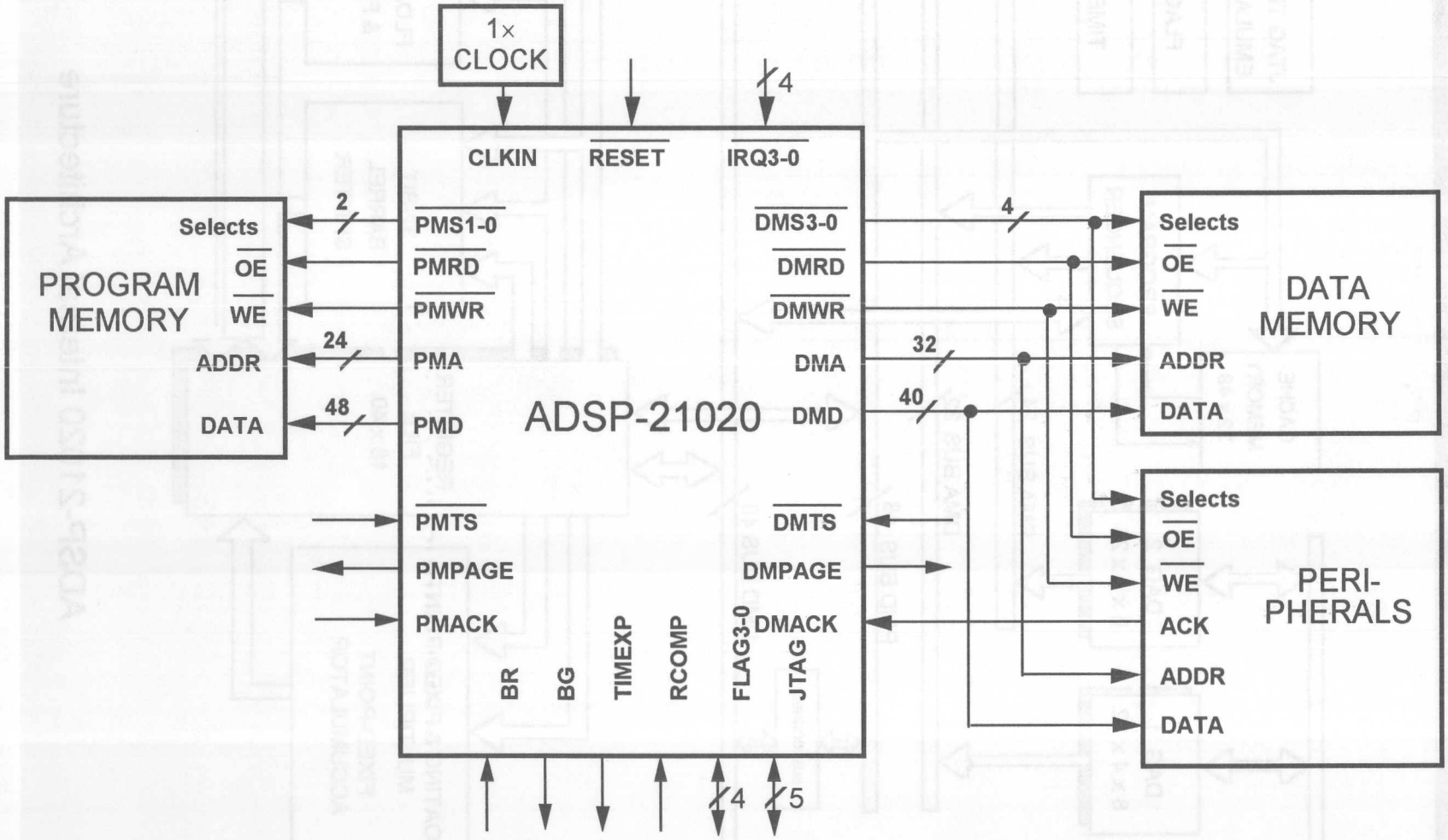
**Preliminary Technical Information*

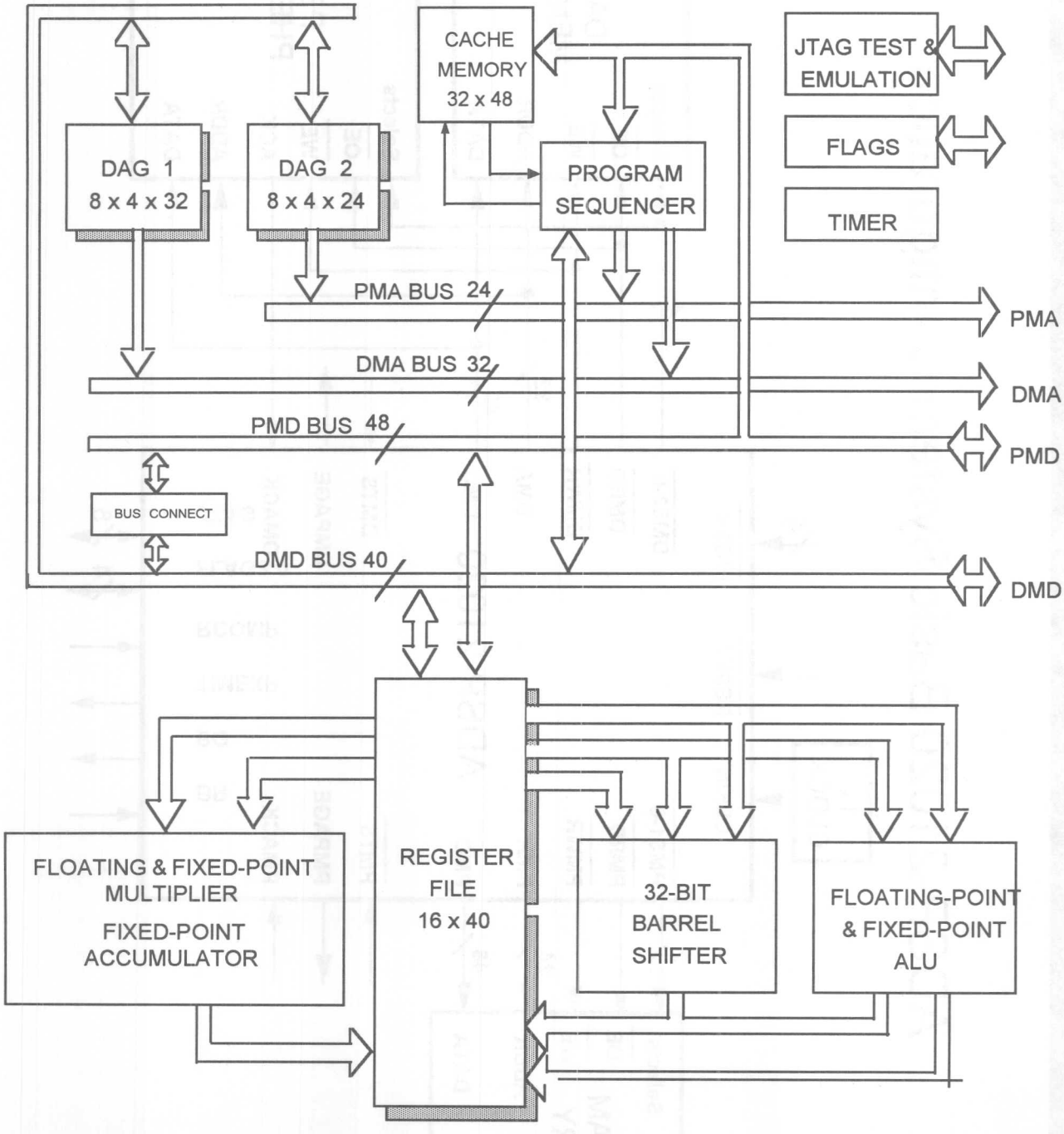
The Modified Harvard Architecture



- **Harvard Architecture :**
  - Simultaneous Access of Data and Instruction
- **Modified Harvard Architecture :**
  - Simultaneous Access of 2 Data Memories and Instructions From Cache
  - Gives 3 Bus Performance With Only 2 Busses

ADSP-21020 Basic System Configuration

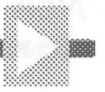




ADSP-21020 Internal Architecture

ADSP-21060 and ADSP-21062 Benchmarks @ 40 MHz

TEST	RESULTS
1024 Pt Complex FFT (RADIX 4, with Digit Reverse)	0.46 ms
FIR Filter Per Tap	25 ns
IIR Filter Per Biquad	100 ns
Divide (y/x)	150 ns
Inverse Square Root ($1/\sqrt{x}$)	225 ns
DMA Transfer Rate	240 Mbytes/sec

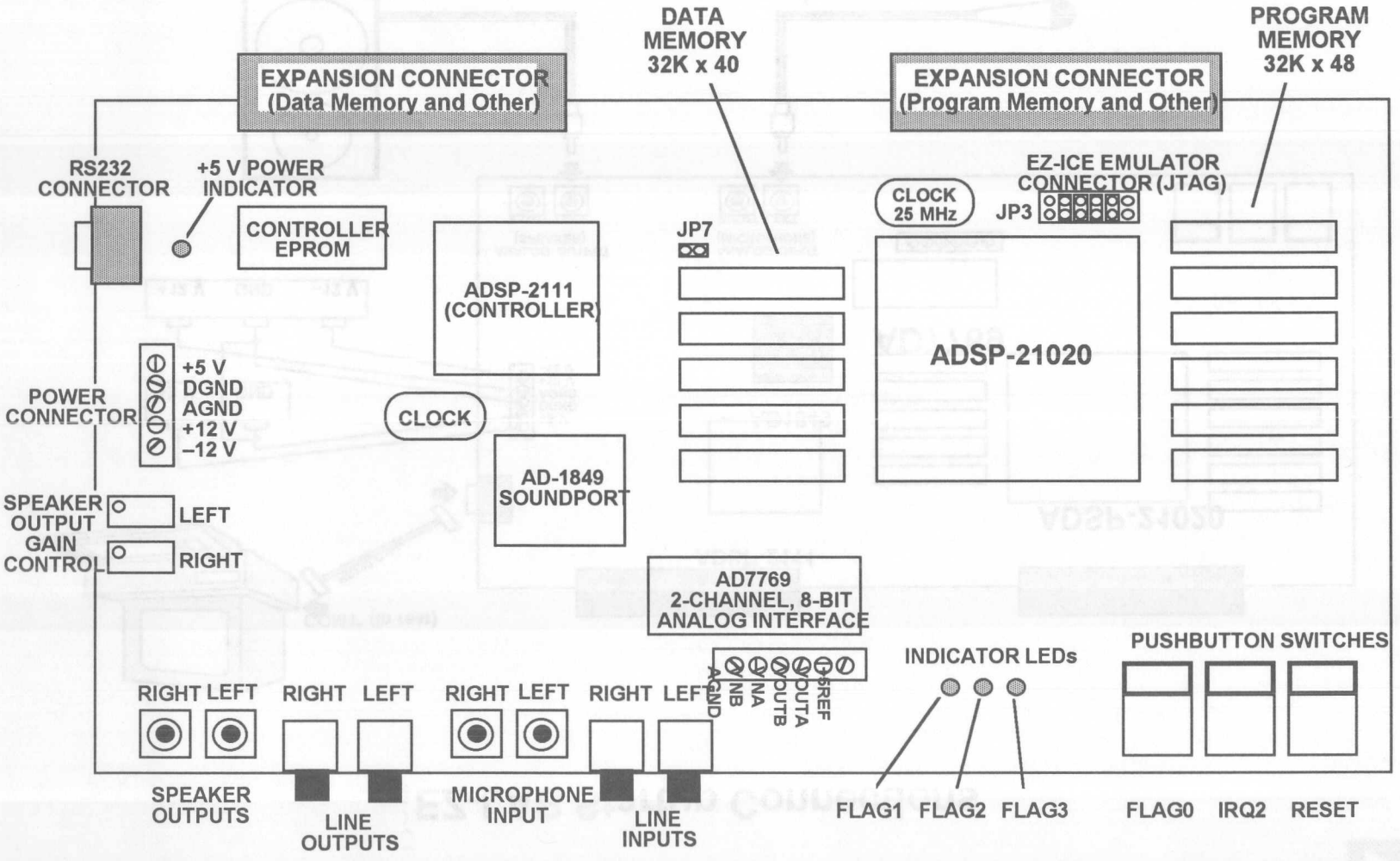


ADSP-21020 EZ-LAB™ Demonstration Board

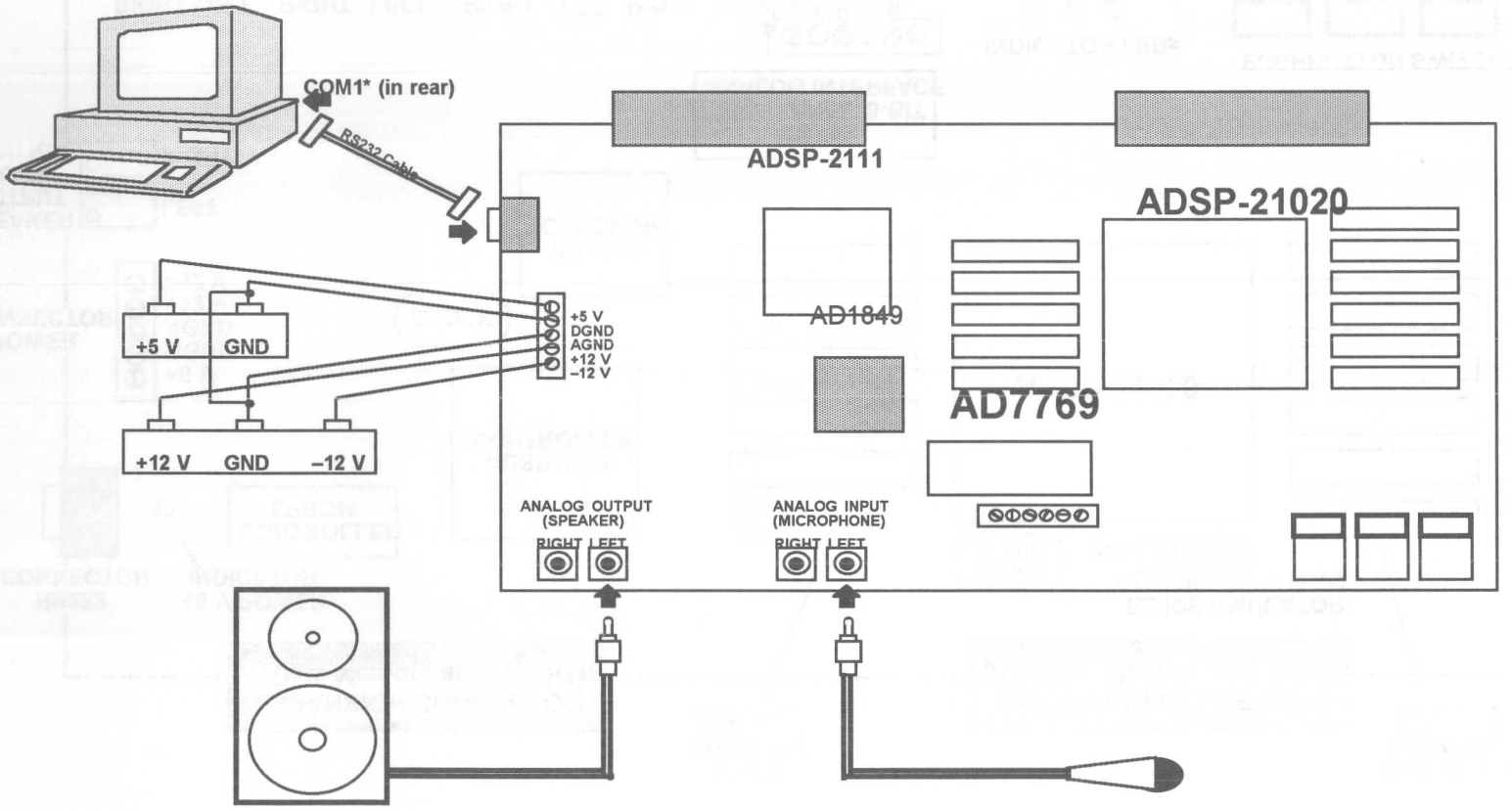
The ADSP-21020 EZ-LAB demonstration board enables low cost evaluation, hardware prototyping and software development and/or acceleration with the following features:

- Operation at 25 MHz
- 32K Words of Program Memory (Zero Wait State SRAM)
- 32K Words of Data Memory (Zero Wait State SRAM)
- 16-Bit Linearly-Coded Soundport™ Stereo CODEC (AD1849)
- 8-Bit Dual A/D and D/A Port (AD7769)
- Expansion Connectors for Access to Data, Address and Control Lines
- Connects to EZ-ICE™ In-Circuit Emulator through JTAG Port
- RS-232 Interface to a PC for Program Download
- 64K x 8-Bit EPROM Containing Demonstration Software

EZ-LAB Board Layout



EZ-LAB Startup Connections



* COM1 for startup procedure; can be COM1 or COM2 normally

ADSP-21020 EZ-LAB™ Operation

EZ-LAB Board Has Two Modes of Operations:

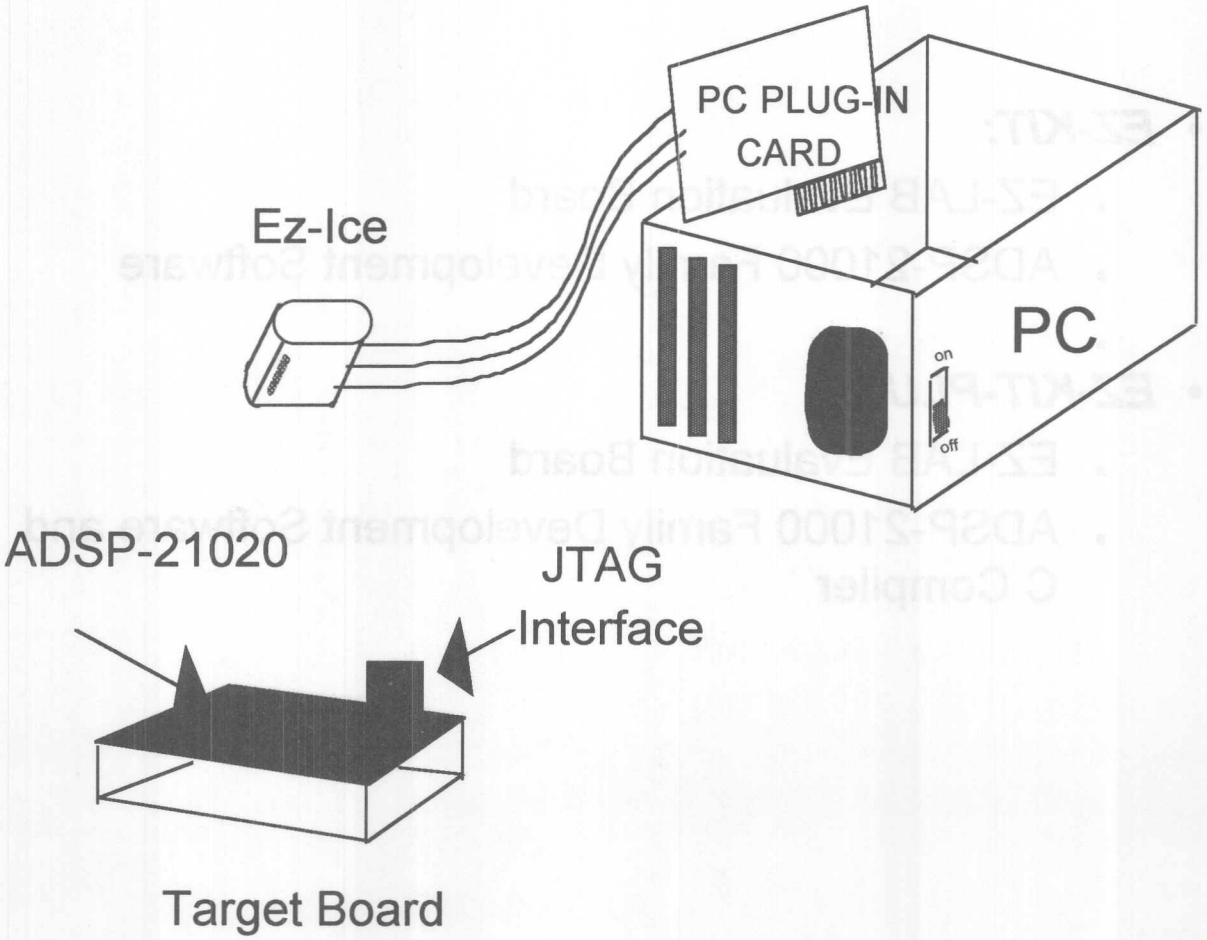
- ***Host Computer Controlled***
  - Attached to Host Via RS-232 Connection
  - Supports Download, Upload, Reset, and Program Execution
  - Host Runs LAB21K.EXE Program
  - Download Files Are in .STK Format From PROM Splitter
- ***EZ-ICE Controlled***
  - EZ-ICE Connects to JTAG Connector on EZ-LAB
  - EZ-ICE Provides Complete in-Circuit Emulation of EZ-LAB

ADSP-21020 EZ-ICE™ In-Circuit Emulator

The ADSP-21020 EZ-ICE in-circuit emulator enables extensive, low-cost, development and debugging of ADSP-21020 systems with the following features :

- Full-Speed, Non-Intrusive Emulation At Target Speed
- Emulator Connection Via 12-Pin JTAG Port
- Same Window Interface As The ADSP-21020 Simulator
- Ability To Examine And Alter All Memories And Registers
- Symbolic Debug And Online Assembly Capabilities
- C Source Level Debug Platform
- 32 Software Breakpoints
- 7 Hardware Breakpoints
- Single- And Multi-Step Commands

ADSP-21000 Ez-Ice: Plug-In Card Setup



ADSP-21000 EZ-KIT Combined Software and Hardware Packages

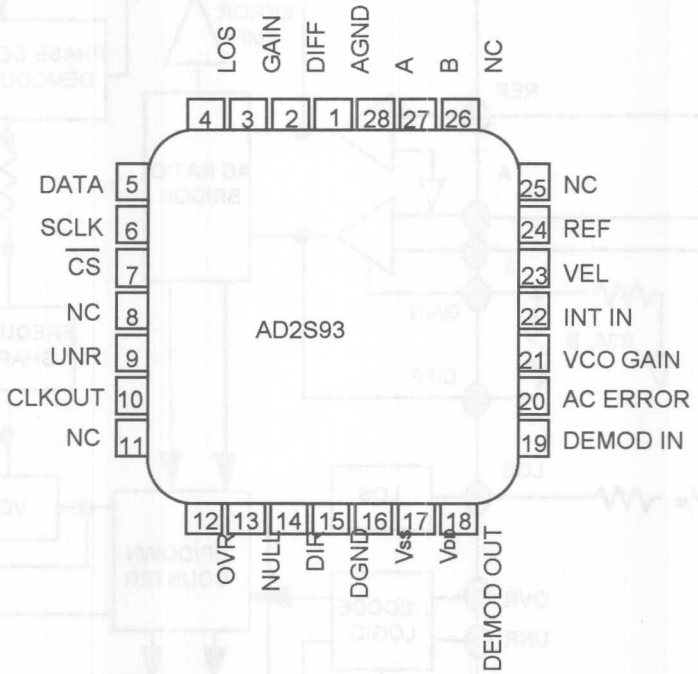
- ***EZ-KIT:***
  - EZ-LAB Evaluation Board
  - ADSP-21000 Family Development Software
  -
- ***EZ-KIT-PLUS:***
  - EZ-LAB Evaluation Board
  - ADSP-21000 Family Development Software and C Compiler

SECTION 12
MOTION CONTROL PRODUCTS

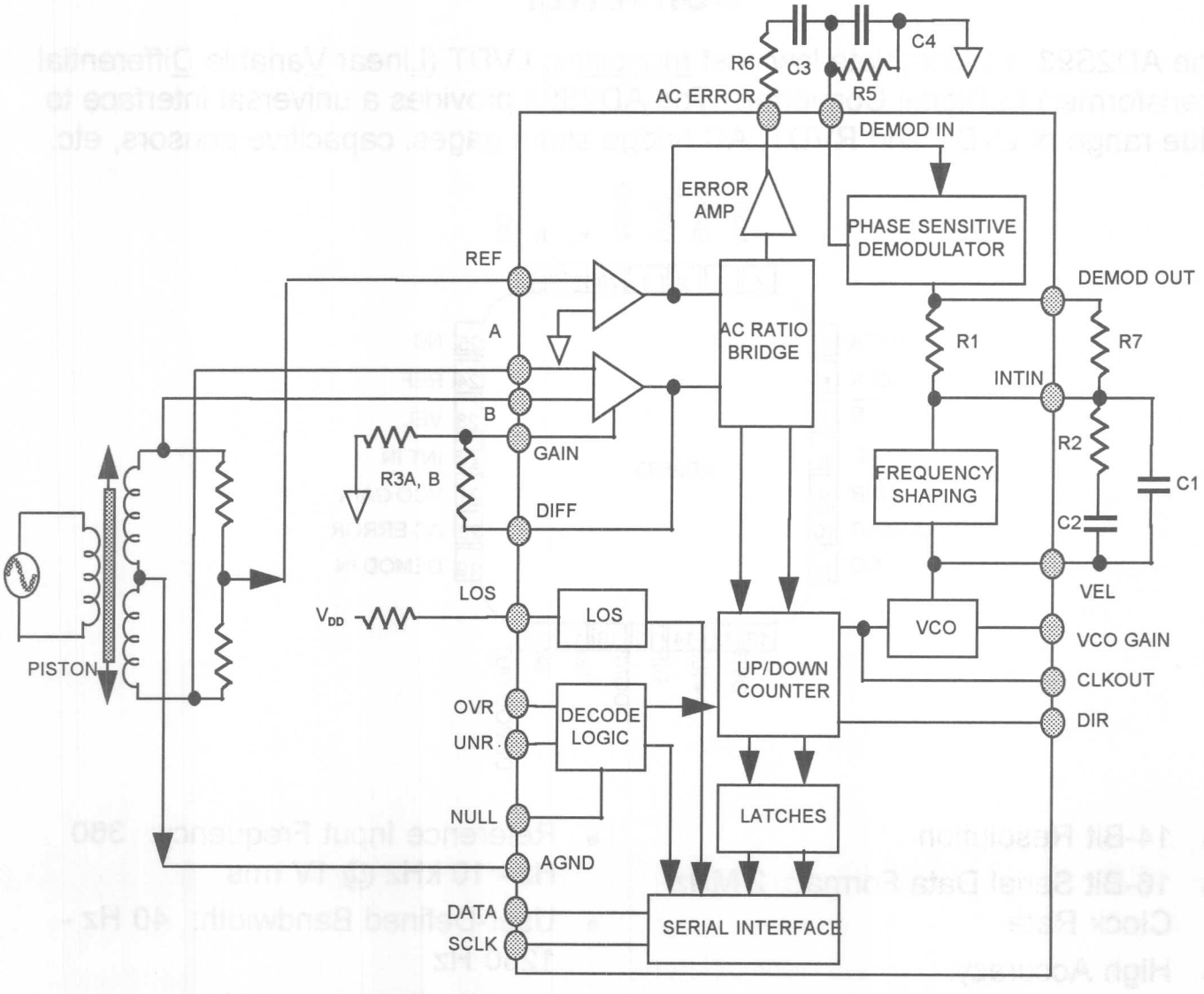
Monolithic LVDT to Digital Converter
Universal Synchro/Resolver, Transformer-Isolated Interface
Three-Phase Current Conditioner
Programmable Sine Wave Oscillator

AD2S93
Low Cost, Monolithic LVDT-to-Digital Converter

The AD2S93 is a complete low cost monolithic LVDT (Linear Variable Differential Transformer) to Digital Converter! The AD2S93 provides a universal interface to wide range of LVDT and RVDT, AC bridge strain gages, capacitive sensors, etc.

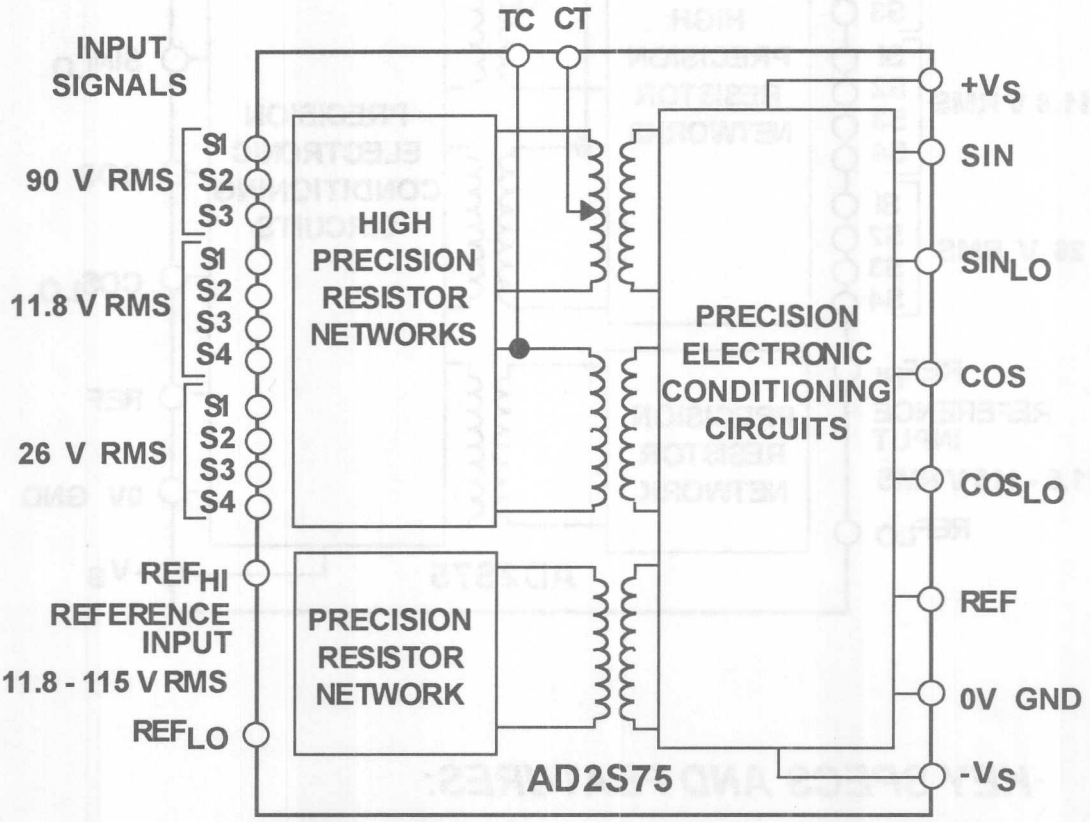


- 14-Bit Resolution
- 16-Bit Serial Data Format: 2 MHz Clock Rate
- High Accuracy:
  - 0.05 % Max Integral Nonlinearity
  - < 1 LSB Max Differential Nonlinearity
  - ± 1 LSB Max Zero Position Error
- Reference Input Frequency: 360 Hz - 10 kHz @ 1V rms
- User-Defined Bandwidth: 40 Hz - 1250 Hz
- Velocity Output: ± 4 Vdc
- Adjustable Gain for A and B Inputs from 1-10
- ± 5V Power Supplies @ 10 mA
- 28-Pin PLCC Package

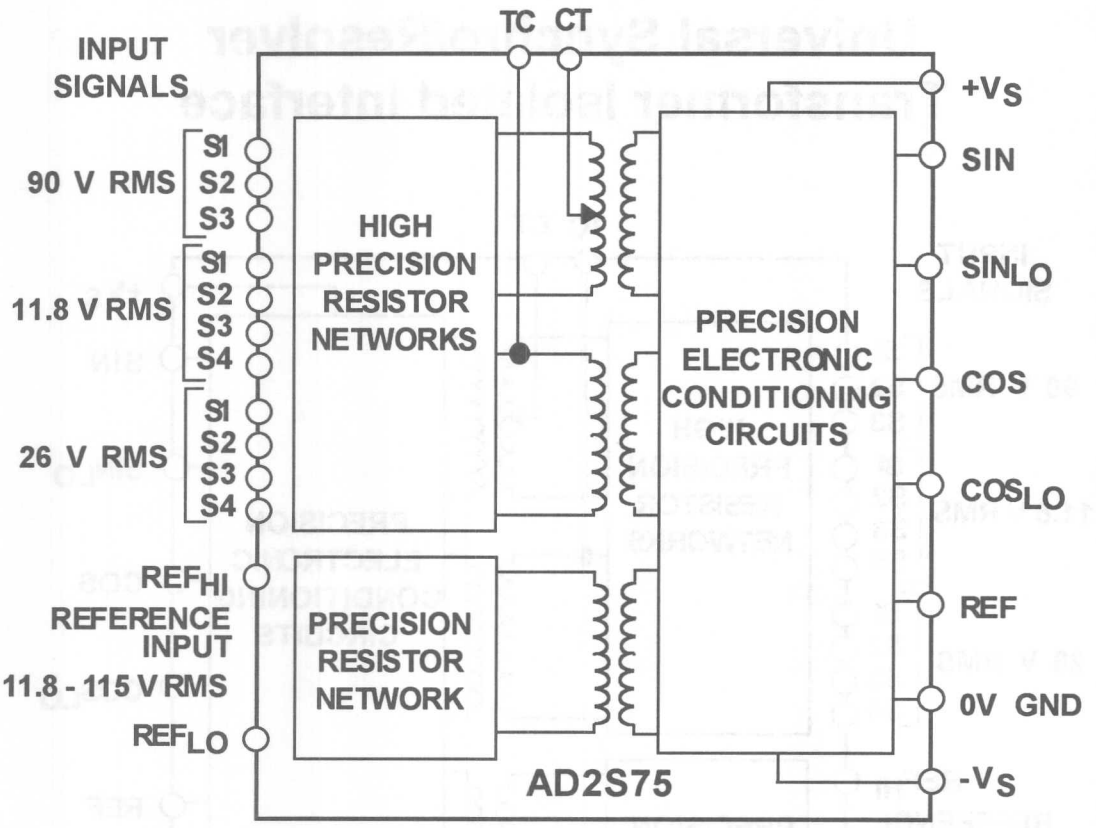


3 or 4 Wire LVDT Connection

AD2S75
Universal Synchro/Resolver Transformer Isolated Interface



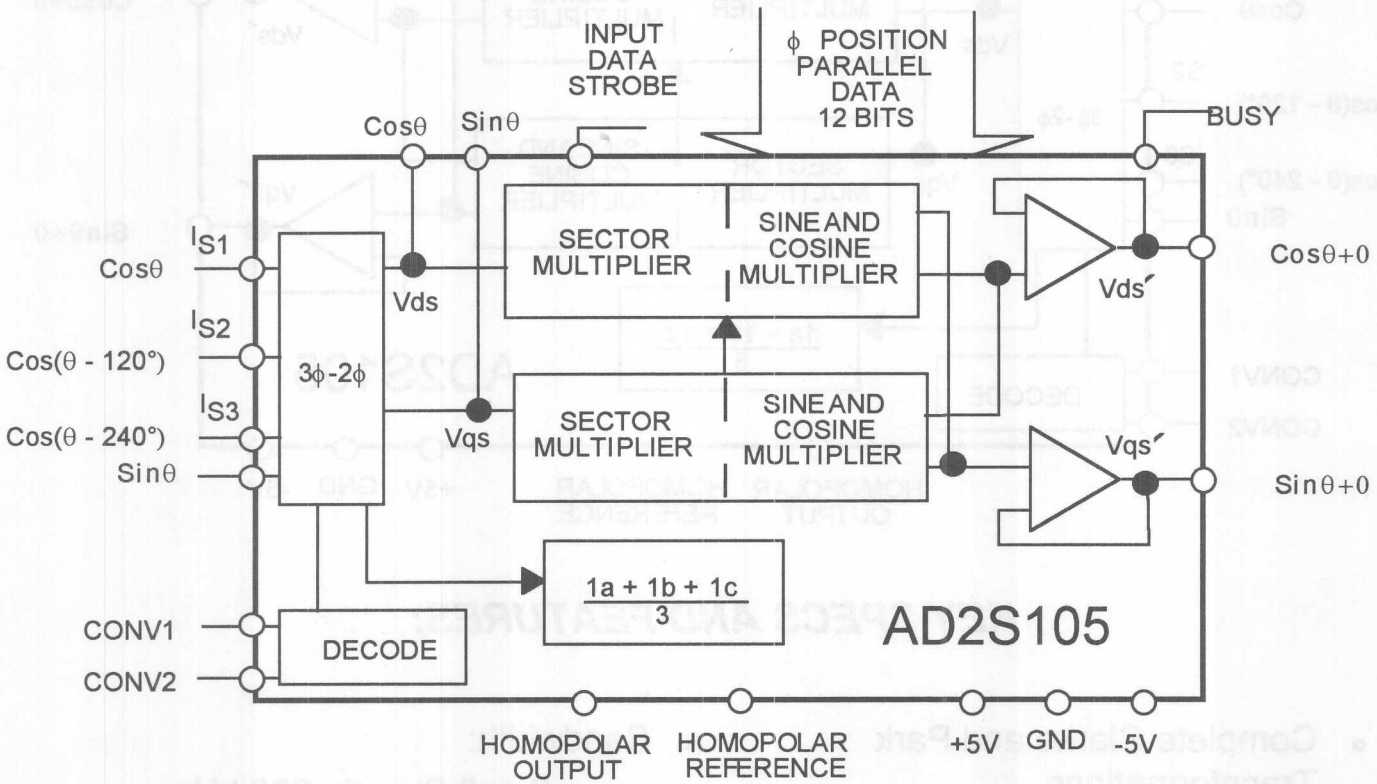
The AD2S75 is a functionally complete, analog signal conditioning transformer that accepts standard synchro and resolver format signals (90V, 26V or 11.8V rms) and converts them to nominal 2V rms sin/cos output signals. In addition, the AD2S75 accepts a standard reference input sine wave and converts it to a nominal voltage output for interface with popular resolver-digital converters.



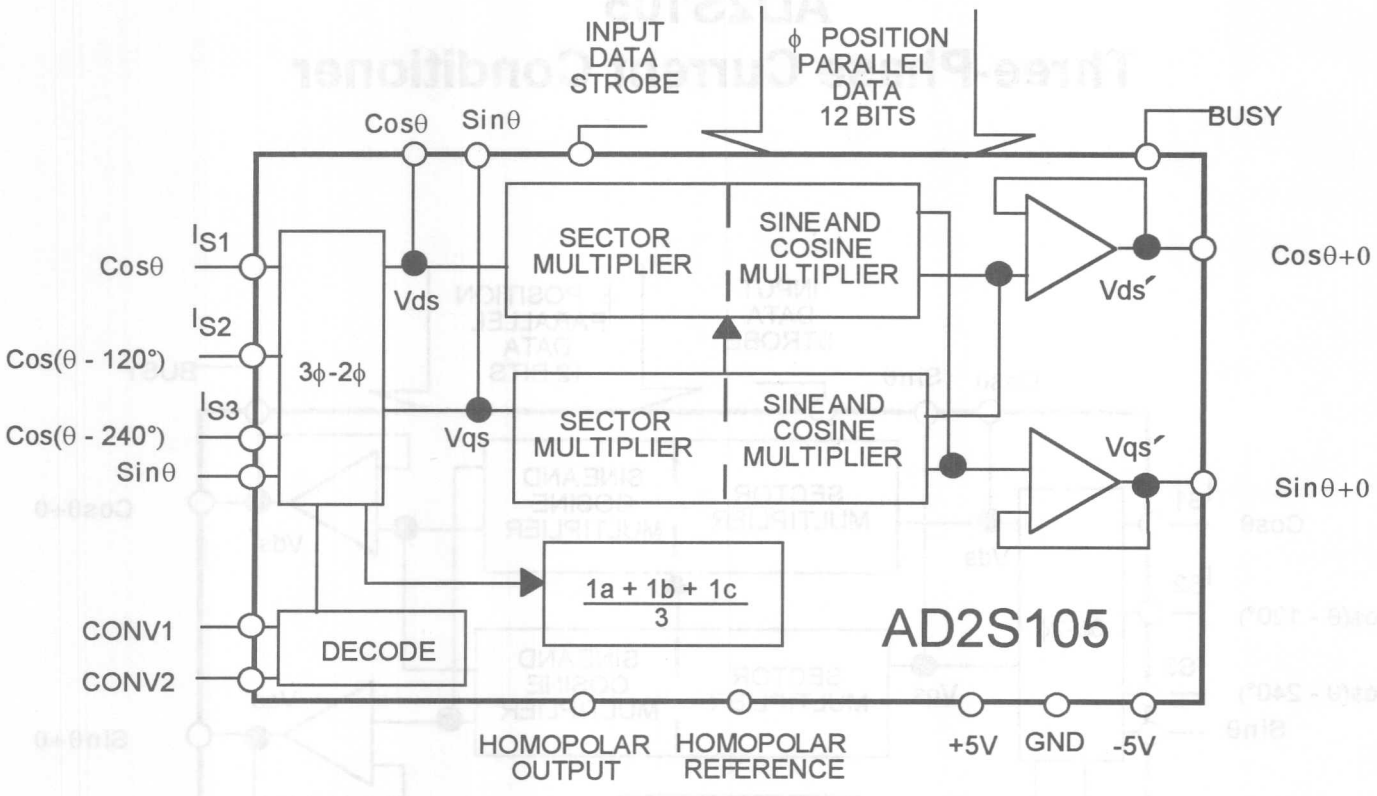
KEY SPECS AND FEATURES:

- Universal Interface for Resolver-Digital Converters
- Synchro-Resolver and Resolver-Resolver Transformations
- Reference Frequency Range from 56 Hz to 20 kHz
- Reference Frequency Input from 11.8 - 115 V rms
- High Accuracy over Full Temp Range: 2.5 arc min, max
- True Galvanic Isolation up to 1000V rms
- Power Supply Range from ± 5V to ± 15V dc
- Dimensions: 1.37 x 1.1 x 0.3 inches (35 x 27.7 x 7.6 mm)

AD2S105
Three-Phase Current Conditioner



The AD2S105 performs the vector rotation of three-phase 120 degree or two-phase 90 degree sine and cosine signals by transferring these inputs into a new reference frame which is controlled by the digital input angle, ϕ. Real-time computation removes time-consuming Cartesian transformation requirement from digital processors and results in a significant speed improvement over single processor designs.

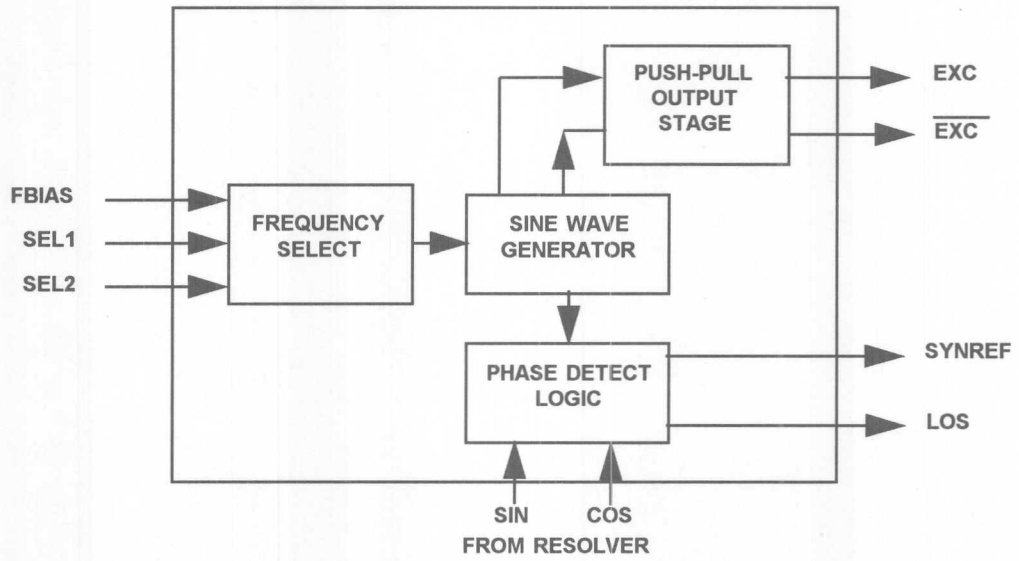


KEY SPECS AND FEATURES:

- Complete Clarke and Park Transformations
- Detect Three-Phase Imbalance via Homopolar Output
- Analog Signal Inputs and Outputs: ± 2.8V dc
- Output Offset Voltage: ± 10 mV, max
- Maximum Angular Error: ± 30 arc min
- Radius Error: 1.0 % max
- Bandwidth:
  - Small Signal: 200 kHz
  - Full Power: 50 kHz
- Settling Time: 1 µs to ± 1 LSB
- Power Supplies: ± 5V @ 10 mA, max
- -40 deg C to +85 deg C Operation
- 44-Pin Plastic Leaded Chip Carrier Package

AD2S99
Programmable Sine Wave Oscillator

The AD2S99 is a programmable sine wave oscillator designed to be used to excite resolvers and a wide reange of AC sensors. The AD2S99 provides a unique dynamic phase compensation and loss of signal (LOS) detection.



KEY SPECS AND FEATURES:

- 2 kHz to 20 kHz Programmable Output Frequency Range
- "Loss-of-Signal" Indicator
- Single Supply Operation :
  - +5V @ 8 mA typ
- -40 deg C to +85 deg C Operation